

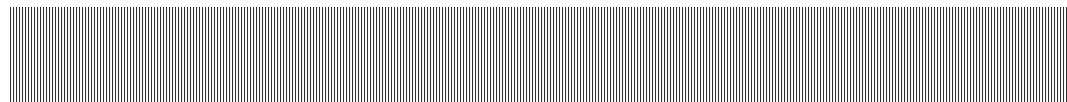
Metal Bank NPL Site

7301 Milnor Street, Philadelphia, Pennsylvania

Metal Bank NPL Site Remediation Project

Remedial Action Report/ Engineer's Report

March 2013



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Certification

To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



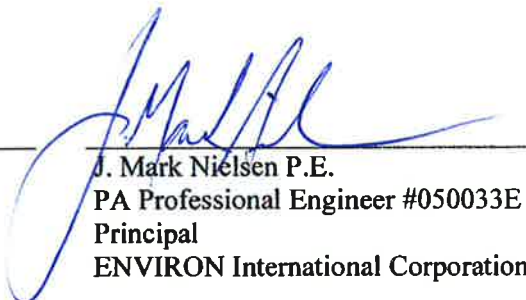
George Horvat
Utility Group Project Coordinator
PECO-an Exelon Company

Statement on Completion in Satisfaction of Consent Decree

We state and affirm that based on our inquiry of those individuals immediately responsible for obtaining the information contained herein, the Remedial Action has been completed in full satisfaction of the requirements of the Utility Consent Decree.



George Horvat
Utility Group Project Coordinator
PECO-an Exelon Company



J. Mark Nielsen P.E.
PA Professional Engineer #050033E
Principal
ENVIRON International Corporation

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Executive Summary

The Metal Bank NPL Site (Site) is located on the western shore of the Delaware River in a heavily industrialized section of northeastern Philadelphia, Pennsylvania (see Figure 1). The northern portion of the Site is located on relatively unaltered river shore deposits and the larger southern portion of the Site is located on reclaimed riverbed/mudflats and consists of artificial fill and construction debris placed on-Site over time. In the late 1960s and early 1970s, the site was used for electric transformer and other salvage operations. According to page 1-3 of Earth Tech, Inc.'s 1994 Final Remedial Investigation Report, approved by the U.S. Environmental Protection Agency (USEPA), "testing of on-site soils and adjacent river and mud flat sediments identified sporadic concentrations of [polychlorinated biphenyl] PCBs around the site that may be the result of poor 'housekeeping' during reclamation, and that may have resulted from alleged seepage of oil and PCBs from the [underground storage tank] UST to the river and mud flat sediments." The Site has been the subject of litigation initiated by the United States on behalf of the USEPA since April 1980. In March 2006, the United States and other parties entered into three separate consent decrees and an agreement with the City of Philadelphia that resolved the litigation. The members of the Cottman Avenue PRP Group (Utility Group) and the United States entered into a consent decree (the Utility Consent Decree) that provides for remediation of the Site.¹

The Site consists of three areas of concern: (a) the Courtyard Area, located on the northern portion of the property; (b) the Southern Area, located on the southern portion of the property; and (c) the Delaware River Sediment Areas, consisting of a Mudflat and Deep Sediment Areas (see Figures 2 and 3).

The Utility Group submitted a final Remedial Design that the USEPA accepted on April 4, 2008. A companion Remedial Action Work Plan (RAWP) was developed by the selected remediation contractor, Tetra Tech EC, Inc. (TtEC), to describe the means and methods for implementing the final design. USEPA also accepted the RAWP on April 4, 2008². A second RAWP dated July 6, 2009 was prepared by Severson Environmental Services of PA, Inc. (Severson). These documents, along with the plans and specifications, were the basis for the final Site remedy construction activities. Oversight and supervising contractor roles were provided by Malcolm Pirnie, Inc. (Malcolm Pirnie) to assure compliance with the regulatory agreements, designs, plans, and specifications. The document herein provides certification that the Work was performed in satisfaction of the Utility Consent Decree.

The constructed remedy consists of the following components:

¹ *United States v. Union Corp.*, C.A. No. 80-1589 (E.D. Pa.), (consent decrees entered by the Court on March 14, 2006).

² The RAWP was further amended to reflect modifications in the sediment and upland capping/LNAPL trench construction when Severson Environmental Services Inc. took over the construction in July of 2009.

Executive Summary

- Excavation of Courtyard Area soils, and placement of a soil cap over the Courtyard Area and foundations of former Buildings 2, 3, 4, 5 and 6;
- Power washing and sealing of Courtyard Building 7 floor slab and railroad spur within Building 7 (with an appropriate coating approved by USEPA) in accordance with Appendix C of the Consent Decree, Section B;
- Installation of a sheet pile wall at the southwestern corner of the Site;
- Removal of the underground storage tank (UST) near the southwestern corner of the Site and removal and closure of other USTs encountered during the remedial action;
- Excavation and off-Site disposal of soil from Southern Area “hot spots” SA-2, SA-3, and SA-4/5;
- Installation of a soil cap over the Southern Area;
- Excavation of near-shore sediments and capping of other sediment areas shown in the past to contain concentrations of total PCBs greater than 1 ppm;
- Pre- and post-construction monitoring; and
- Institutional controls.

The construction of the remedy was accomplished in two phases with Phase 1 (mainly upland excavation activities, Building 7 sealing, and permanent soils & erosion controls) performed by TtEC and Phase 2 (mainly sediment excavation/capping, upland capping, LNAPL Trench installation, monitoring well installation, and security fencing) performed by Severson.

The Remedial Action Report/Engineer's Report documents that all components of the USEPA approved remedy were constructed in a manner that met the requirements established by the Record of Decision (ROD), two USEPA Explanations of Significant Differences (ESD), the Utility Consent Decree, the final Remedial Design, and the two RAWPs. Any deviations from the approved documents were appropriately approved by either: the design engineer, AMEC Earth & Environmental, Inc. (AMEC); the supervising contractor and resident engineer, Malcolm Pirnie (ENGINEER); and/or USEPA.

This report contains three major sections:

- Project Background
- Project Administration
- Remedial Action

Executive Summary

The Project Background section of the report provides an overview of the Site and Project History, discusses Project Construction Implementation, and identifies the Project Participants.

The Project Administration section of the report identifies the project documentation utilized to manage the daily construction activities, document approved changes or deviations from the approved design plans, present technical documentation supporting specific elements of the remedial action, and document as-built conditions.

The Remedial Action section of the report provides a description of the work performed as part of the approved remedy for the Site.

The report concludes with a summary of Operation and Maintenance Activities and identification of project contacts for the Utility Group and its contractors.

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1. Project Background

1.1. Site and Project History

The Site is located on the western shore of the Delaware River in a heavily industrialized section of northeastern Philadelphia, Pennsylvania (see Figure 1). The northern portion of the Site is located on relatively unaltered river shore deposits, in comparison to the remainder of the Site. The larger southern portion of the Site is located on reclaimed riverbed/mudflats and consists of artificial fill and construction debris placed over time. The Site is inactive, with one building, six former building foundations, and a new 6-foot-high fence that restricts access and completely surrounds the Site. The Site is bordered by Cottman Avenue and a mudflat on the west, Milnor Street to the north, Revolution Recovery, Inc. (a recycling operation formerly known as Safe Disposal Systems, Inc.) and Morris Iron & Steel Company (a metal salvage yard) on the east, and the Delaware River to the south. The former St. Vincent's School, an inactive school, is located to the west of the Site across Cottman Avenue. A City of Philadelphia combined sewer outfall that empties into the mudflat area is located at the southern end of Cottman Avenue. A marina (Quaker City Yacht Club) is located adjacent to the mudflat farther to the west.

The available records are unclear as to what, if any, manufacturing or related activities took place on the Site before 1955, the period when the Site was owned by a power equipment manufacturing firm. Similarly, when the property was under new ownership between 1955 and 1962, available records do not specify Site use. However, beginning in 1962, when the Site purchase by the predecessor to the Metal Bank of America (Metal Bank) acquired the property, reports indicate that the Site was used for the storage and reclamation of various scrap metals. According to a USEPA letter dated July 12, 1979, Metal Bank had ceased activities on the property. However, reports suggest that the Site was used as a storage facility for scrap metal until as late as 1984 or 1985. Aerial photographs indicate there was also a large automobile parking area in the Southern Area at one time.

Metal Bank conducted electrical transformer salvage operations on the Site from at least late 1968 or early 1969 until 1973. According to page 1-8 of the EPA approved 1994 Final Remedial Investigation Report prepared by Earth Tech, Inc., "Some of the transformers handled at the site may have contained PCB-bearing oil." Reports indicate that oil from the transformers was drained onto a graded concrete pad that was connected to a UST. Spills of the oil and a possible release, or spills and overfills from the UST,

caused soil and groundwater contamination at the Site. Furthermore, as part of the metal recycling activities during the period from 1968 to 1972, copper wire, and perhaps other materials, may have been burned at the Site to remove insulation in preparation for copper reclamation.

The investigative and enforcement history of the Site began in 1972 when reports of oil seeping from the banks of the Delaware River at the Site prompted the United States Coast Guard (USCG) to conduct a series of visual inspections of the Site and the Delaware River bank. The Site has been the subject of numerous investigations and attempted oil recovery activities since that time; a summary of these efforts can be found in the Remedial Design Work Plan (RDWP) dated August 16, 1999, the Pre-Design Investigation (PDI) Report dated January 21, 2000, and the USEPA's 2003 pre-remedy sampling event.

In 1991, USEPA and some members of the Utility Group entered into an Administrative Order on Consent under which the Utility Group prepared a remedial investigation and feasibility study (RI/FS) that EPA approved in April 1994. EPA issued a Proposed Plan in mid-1995 and, after receiving and considering comments, issued the ROD in December 1997. In 1998, USEPA issued a unilateral Administrative Order to the members of the Utility Group, Metal Bank, Union Corporation (Metal Bank's owner), and Irvin and John Schorsch (the owners of the Site) requiring them to prepare a remedial design of the ROD remedy. The Utility Group retained AMEC (formerly Ogden Environmental Services) to prepare the design. As part of that effort, AMEC collected additional data that it incorporated into the January 2000 PDI Report. On September 16, 2002, the Utility Group submitted a Final Design Report. The USEPA approved the Final Design in January 2003, but the remedy in the Final Design was not immediately implemented due to the ongoing litigation. As part of its litigation efforts, the United States collected additional data and performed certain analyses of Site data in early 2003. Analyses of the new data, the continued evaluation of remedial options, and an initiative to resolve all claims in the litigation led USEPA and the Utility Group to jointly develop a Revised Remedial Plan dated June 29, 2004. The Utility Group incorporated the changes set forth in the Revised Remedial Plan and submitted a revised Remedial Design to the USEPA on April 13, 2006. USEPA commented on this document in its letter dated July 12, 2006. The Remedial Design was then modified and re-submitted on February 16, 2007; and after receiving additional comments from the USEPA, AMEC modified and again re-submitted the Remedial Design to USEPA on November 9, 2007. The final Remedial Design incorporating all comments was accepted by the USEPA and finalized on April 4, 2008. A companion RAWP was developed by TtEC to describe the means and methods for implementing the Final Remedial Design. TtEC finalized its RAWP on April 4, 2008. A second RAWP, dated July 6, 2009, was prepared by Severson.

The final Site remedy consists of the following components:

- Excavation of Courtyard Area soils, and placement of a soil cap over the Courtyard Area and foundations of former Buildings 2, 3, 4, 5 and 6;
- Power washing and sealing of Courtyard Building 7 floor slab and railroad spur within Building 7 (with an appropriate coating approved by USEPA);
- Installation of a sheet pile wall at the southwestern corner of the Site;
- Removal of the UST near the southwestern corner of the Site and removal and closure of other USTs encountered during construction of the remedy;
- Excavation and off-Site disposal of soil from Southern Area “hot spots” SA-2, SA-3, and SA-4/5;
- Installation of a soil cap over the Southern Area;
- Excavation of near-shore sediments and capping of other sediment areas shown in the past to contain concentrations of total PCBs greater than 1 ppm;
- Pre- and post-construction monitoring; and
- Institutional controls.

1.2. Project Construction Implementation

The remedial action field activities were initiated in June 2008 by TtEC. TtEC performed the excavation of soil from the Courtyard Area, placed the soil cap over the Courtyard Area, power washed and applied epoxy over the concrete surfaces within Building 7, installed components of the sheet pile wall, removed the UST from the Southern Area, excavated hot spots SA-2, SA-3, and SA-4/5 in Southern Area, and installed the subaqueous cap in the Central Cap Area. Due to severe winter conditions, construction work at the Site was shut down in February 2009. During the winter shut down, the Utility Group elected to replace TtEC with Severson.

Phase 2 of the remedial action was initiated by Severson in July 2009. Severson completed the installation of the sheetpile wall by installing the tiebacks and placing backfill behind the wall, installed the Southern Area Cap, excavated the mudflat and deep water sediments, installed the subaqueous cap in the Eastern and Western Cap Areas, completed the cap in the Central Cap Area, installed an LNAPL monitoring trench, installed groundwater monitoring wells, and installed a chain link fence around the perimeter of the Site. The remedial action construction activities were completed in January 2010, a pre-final inspection was performed by the USEPA on January 20, 2010, and a final inspection was performed by USEPA on April 29, 2010.

1.2.1. Chronology of Events

September 2002

- Final Design Report Submitted Under Unilateral Administrative Order

January 2003

- Final Design Report Approved

November 2007

- Final Remedial Design Submitted

April 2008

- Final Remedial Design Approved
- Tetra Tech Remedial Action Work Plan Approved

June 2008

- Beginning of Phase I Work
- Clearing and Grubbing of Site

July 2008

- Courtyard Excavations Completed
- Well Abandonment Completed
- Construction of Soil and Sediment Management Pad Completed
- Power Washing and Sealing of Courtyard Building 7 Initiated

August 2008

- Installation of Sheet Pile Wall Completed
- Excavation of SA-2 and SA-3 Initiated

September 2008

- Courtyard UST and Vault Closure Completed
- Excavation of SA-2 and SA-3 Completed

October 2008

- Repairs of Soil and Sediment Management Pad Completed
- Removal of SA-4/SA-5 UST Completed
- Preparation and Grading of Southern Cap Area Completed
- Excavation of SA-4/SA-5 Initiated

November 2008

- Installation of Subaqueous Cap in Central Cap Area Initiated

December 2008

- Power Washing and Sealing of Building 7 Completed
- Excavation of SA-4/SA-5 Completed

February 2009

- Phase I Completed – Winter Shutdown Begins

July 2009

- Severson Remedial Action Work Plan Approved
- Beginning of Phase II Work
- Clearing and Grubbing of Site
- Turbidity Monitors Installed

August 2009

- Upgrades and Repairs of Soil and Sediment Management Pad Completed
- Turbidity Curtains and Oil Booms Installed
- Super Silt Curtain in Mudflat Area Installed
- Temporary Sheet Pile Installation Initiated
- Mudflat Sediment Excavation Initiated

September 2009

- Temporary Sheet Pile Installation Completed
- Deep Sediment Area Excavation Initiated
- Subaqueous Cap Installation Initiated

October 2009

- LNAPL Monitoring Trench Installation Initiated

November 2009

- Repairs to Sealing in Building 7 Completed

December 2009

- Removal of Soil and Sediment Management Pad Completed
- Mudflat and Deep Sediment Area Sediment Excavation Completed
- LNAPL Monitoring Trench Installation Completed
- Monitoring Well Installation Completed

January 2010

- Closure of UST along Cottman Avenue Completed
- Installation of Southern Cap Area Completed
- Installation of Subaqueous Cap Completed

- Phase II Completed
- Pre-Final EPA Inspection Conducted

April 2010

- Final EPA Inspection Conducted

1.3. Project Participants

The main participants involved in the project include:

- USEPA – Lead Regulatory Agency
 - United States Army Corp of Engineers (USACE) – Regulatory Oversight – River Activities
 - Camp Dresser McKee (CDM) – USEPA’s oversight contractor – Upland Activities
- Pennsylvania Department of Environmental Protection (PADEP)
- Delaware River Basin Commission (DRBC)
- Cottman Ave PRP Group (Utility Group)
 - Baltimore Gas and Electric Company
 - Consolidated Edison Company of New York
 - Jersey Central Power and Light Company
 - Long Island Lighting Company
 - Metropolitan Edison Company
 - Orange and Rockland Utilities
 - PECO Energy Company
 - Potomac Electric Power Company
 - PPL Electric Utilities Corporation
 - Public Service Electric and Gas Company
 - Virginia Electric and Power Company
- AMEC Earth & Environmental, Inc. – Design Engineer
- Malcolm Pirnie, Inc. – Supervising Contractor and Resident Engineer
- Independent Quality Assurance Team (IQAT)
 - Applied Environmental Management (AEM)
- Tetra Tech EC, Inc. – Remedial Action Contractor, Phase 1

- Midlantic Construction, LLC (Midlantic) – Sheet Pile Wall and Marine Mattress Installation (Central Cap Area)
 - Rettew Surveying (Rettew) – Pennsylvania Licensed Surveyor
 - Alpine Ocean Seismic Survey, Inc. - Side Scan Sonar of Marine Mattress Placement (Central Cap Area)
 - Lewis Environmental – Turbidity Curtain Installation, LNAPL Waste Removal
 - ABC Construction – Cover and Top Soil supplier
 - Waste Management – Waste Disposal
 - Sovereign Environmental – Wastewater Treatment System and Activated Carbon Supplier and Operator
 - Fondriest Environmental – Turbidity Monitor Supplier
 - Divers – Installation of Subaqueous Cap
 - USA Environmental Management, Inc.- Underground Storage Tank Removal
- Severson Environmental Services of PA, Inc. – Remedial Action Contractor, Phase 2
- ABC Construction (ABC) – Soil Supplier
 - Excavating Materials Equipment, Inc. (EME) – Soil Supplier
 - ANS Consulting – Compaction Testing
 - Rettew Surveying – PA Licensed Surveyor
 - Amquip Crane – Crane Rental and Operation
 - J. Ferry Fencing – Fence Installation
 - Fondriest Environmental – Turbidity Monitor Supplier
 - Dryden Divers – Divers for Installation of Subaqueous Cap

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2. Project Administration

2.1. Performance Standards and Construction Quality Control

Achievement of the remedial objectives was realized by strict adherence to the design specifications drafted by AMEC and approved by EPA. A description of the activities completed is provided in Section 3.0 of this report. Construction assurance and construction quality control was provided by submittals, Contractor Change Requests (CCRs), daily reports, disposal documentation, and as-built drawings as discussed in the sections below. An assessment of performance data quality is provided in Section 3.12.7 of this report.

2.2. Submittals

The Specifications required that the Contractor prepare and provide submittals to the Resident Engineer as part of the remedial action activities. Submittals were transmitted to the Resident Engineer in accordance with Specification 01300. During the remedial action construction activities, the Submittals were filed on-Site utilizing a sequential numbering system starting with the letter “F”, designating it as a field submittal, followed by a three digit number, 001 through 153S. The earlier submittals were prepared by TtEC, and the later submittals were prepared by Severson. Submittals prepared by Severson include the letter “S” after the three digit number, indicating a submittal prepared by Severson. A submittal log was utilized to track the status of the submittals. The log and submittal file were available to all project personnel for review. Each submittal includes a Malcolm Pirnie status form, the submittal transmittal form, and the actual submittal document.

The submittal log and submittal files are included with this report in Appendix A.

2.3. Contractor Change Requests (CCRs)

CCRs were utilized to document approved changes or deviations from the design documents, as requests for information, and as budget and scope change order requests. These changes were either approved by EPA, AMEC, or Malcolm Pirnie depending on the requirement. CCRs were filed on-Site in sequence utilizing a three digit number, 001 through 121S. Each CCR file contains a Malcolm Pirnie status form, the CCR form, and supporting documentation, if necessary.

CCRs are included with this report in Appendix B.

2.4. Daily Reports

Each of the Contractors, TtEC and Severson, and Malcolm Pirnie prepared a daily report of activities performed on-Site. The daily reports include information about personnel on-Site, weather conditions, health & safety briefings, equipment usage, material deliveries, materials removed from the Site, monitoring data, quality assurance/quality control (QA/QC) information, subcontractor certifications, progress summaries, as well as a summary of activities completed each day.

The daily reports are included in Appendix C.

2.5. Disposal Documentation

Waste material was removed and disposed at USEPA pre-approved off-Site facilities under one of the following general categories: non-hazardous waste, hazardous waste, or Toxic Substances Control Act (TSCA)-regulated waste. Prior to shipping any waste material, the Contractor sampled, analyzed, and characterized the material for proper disposal. The material was then loaded into trucks for transport to the appropriate disposal facility. Each truck-load of material was accompanied by a waste manifest. Upon arrival at the disposal facility, the waste manifest was signed by an authorized agent for that facility to confirm receipt and acceptance of the waste material. In the case of hazardous waste, as defined under the Resource Conservation and Recovery Act (RCRA), and TSCA-regulated waste, the disposal facility provided letters confirming receipt and acceptance of the material, in addition to signing the manifests.

Copies of the disposal documentation are provided in Appendix D.

2.6. As-Built Drawings

At the conclusion of each definable feature of work, the Contractor submitted drawings prepared by the licensed surveyor confirming that the work activity was completed in accordance with the design drawings and specifications. Each work activity and its submittal number are provided in the list below; these drawings can be found in Appendix E:

Post Excavation Survey – Courtyard Area	Submittal F023
Post Excavation Survey – SA-2 and SA-3	Submittal F033
Post Excavation Survey – SA -4/5	Submittal F091
As-Built Survey – Mudflat and Deep Sediment Excavation	Submittal F129S
As-Built Survey – Subaqueous Cap Central Area	Submittal F130S
As-Built Survey – Subaqueous Cap Eastern Area	Submittal F131S
As-Built Survey – Subaqueous Cap Western Area	Submittal F134S

As-Built Survey – Buttress Eastern Cap Area	Submittal F137S
As-Built Survey – Buttress Central Cap Area	Submittal F138S
As-Built Survey – Buttress Western Cap Area	Submittal F139S
As-Built Survey – LNAPL Trench	Submittal F146S
As-Built Survey - Cover System and Sheet Pile Wall	Submittal F151S

Additional As-Built survey drawings showing the location of the deadmen and tiebacks and the coordinates of the corners of the sub-aqueous cap have been added to Appendix E.

Each drawing is provided in Adobe Acrobat .pdf format. In addition, Autodesk AutoCAD 2008 .dwg files are included in Appendix E. For full functionality, Appendix E includes the digital terrain model (DTM) database. This database contains the three dimensional points and breaklines displayed on the as-built figures.

The final survey points were collected on 12/7/2010. All survey points along the sheetpile wall were collected from shore at the riverside joints between individual pieces of sheetpile. The elevations of each sheetpile wall section are contained in the AutoCAD files on a layer labeled “X-PNTS-SPW-NICK.”

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3. Remedial Action/Construction Activities

Implementation of the Revised Remedial Plan was conducted by two contractors during the course of the construction phase. TtEC conducted the Phase 1 of the work from June 30, 2008 through February 6, 2009 using the approved April 4, 2008 Design, Plans and Specifications as well as its approved April 4, 2008 RAWP. Severson performed Phase 2 of the work and completed the remedy during July 20, 2009 through January 22, 2010 using the approved April 4, 2008 Design, Plans and Specifications, the approved TtEC April 4, 2008 RAWP, and the Severson modified RAWP approved July 6, 2009. The following summarizes work completed by both contractors.

3.1. Erosion and Sediment Control

The Erosion and Sediment (E&S) Control aspect of the work was implemented in accordance with Section(s) 5.4.1.5 and 5.4.4 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, page 4. The work requirements were established by Specification(s) 01110 – Environmental Protection, 3.01 Erosion Control and depicted on Plan(s) C-1, C-19, and C-20. Modifications to the E&S measures are documented in CCR 13, and are described below. Additionally, the construction data (daily inspections) collected during this work was performed according to the design requirements and is presented in the daily reports. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. This E&S Control aspect of the work was initiated on June 30, 2008 and was ongoing throughout the duration of the construction activities. Presented below are further details on the accomplishment of the work.

TtEC installed the perimeter E&S control measures per the RAWP Section 5.4.1.5 during the initial stages of construction just prior to initiating excavations. Limited site disturbances prior to installation of erosion controls were required to install the silt fence. Excavation in the Courtyard Area began when E&S controls were installed in the immediate area but had not been installed around the entire site perimeter. Installation of E&S controls was completed prior to initiating excavations in the Southern Area. The super silt fence and silt fence was installed around the down gradient perimeter of the Site and at the top of the slope, as shown on Design Drawings C-1, C-19 and C-20 and as per Specification 01110. Materials used to construct the E&S control measures are outlined in CCR 13. CCR 13 was a request from TtEC to utilize solid metal posts, rather than hollow, galvanized posts, and 14-gauge welded wire mesh, rather than chain-link fence, which in TtEC's opinion was a more robust fence. CCR 13 was approved by

USEPA and PADEP, in addition to the Engineer. Once in place, TtEC inspected all E&S control measures daily and after storms of 0.5 inches of rain or more over a 24-hour period. Inspections were performed and sediment was removed from the upstream side of the silt fence once the accumulation reached 6 inches or sooner, as needed. Any items found noncompliant with this plan were either repaired or replaced immediately. The Quality Control Manager (QCM) had the authority to stop work until these repairs were completed.

During the winter shutdown, Malcolm Pirnie performed weekly inspections of the Site and its E&S control measures. Damaged or underperforming E&S control measures were repaired or enhanced as necessary.

Prior to the commencement of the Phase 2 construction activities, Severson inspected all E&S controls installed by TtEC and determined which areas were functional and where new/improved E&S measures were necessary per the Severson RAWP. New silt fence was used to minimize the transport of sediment in storm water runoff. New super-silt fence was installed between rows of existing vegetation and along the perimeter of the down gradient portion of the Site, at the top of the slope. Severson installed new super-silt fence on the riverside of the Site to prevent the possibility of eroded Site sediments from reaching the Delaware River. Severson placed the bottom 6 inches of the silt fence fabric in a shallow trench and covered it with soil to prevent sediment migration. Sediment and erosion control practices were consistent with currently acceptable practices, including the placement of new silt fencing and erosion control tubes (coir logs) to mitigate sediment transport; the use of berms and trenches to re-direct surface water run-off/run-on to prevent contamination of adjacent properties; and the use of oil absorbent booms, where applicable, to prevent the flow of contaminated liquids from entering navigable waterways and/or storm sewer pathways. Prior to performing any intrusive work at the Site, Severson installed temporary erosion and sediment control measures as specified.

In water channel areas, Severson placed straw bales in front of the silt fence to reduce stress on the silt fence and aid in collecting sediments. In areas where straw bales had been previously placed by TtEC and were no longer effective, Severson replaced them with erosion control tubes (coir logs).

Once in place, Severson inspected all control measures daily and after storms of 0.5 inches of rain or more over a 24-hour period. Inspections were performed and sediment was removed from the upstream side of the silt fence once the accumulation reached 6 inches or sooner, as needed. Any items found noncompliant with this plan were either repaired or replaced immediately. Severson's QCM had the authority to stop work until these repairs were completed.

Portions of the silt curtain were removed in December 2009 to facilitate work in the river.

3.2. Clearing and Grubbing

The Clearing and Grubbing aspect of the work was implemented in accordance with Section(s) 5.4.4 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, page 21. The work requirements were established by Specification(s) 02110 – Clearing and Grubbing and depicted on Plan(s) C-2. There were no Submittals or CCRs associated with this aspect of the Work. However, the construction data and daily observations performed by the Contractor and Engineer during this activity confirmed that the WORK was performed in accordance with the design requirements. The Clearing and Grubbing aspect of the work initiated by TtEC on June 30, 2008 was substantially complete by July 11, 2008. Additional clearing was performed by Severson between July 20, 2009 and July 27, 2009. Presented below are further details on the accomplishment of the work.

Clearing and grubbing was performed in the Courtyard Area prior to performing excavation of contaminated soils by TtEC. To the extent practical, a narrow strip of vegetation was left along the existing fence line until near project completion (i.e., after the majority of the intrusive excavation was complete). The vegetation provided a visual barrier and a noise and dust buffer, as well as provided some erosion control, between the Site and the former St. Vincent School.

TtEC cleared the remainder of the project Site and the Southern Area immediately following the excavation of Courtyard Area. Above grade materials from the clearing operations were transported off-Site for re-use. The below grade material was chipped and was dispersed beneath the soil cap.

During Phase 2, Severson clearing and grubbing activities were related to invasive species removal for grasses, weeds, and woody species that had grown on the Site during the winter and spring/summer growing periods prior to the recommencement of Work on July 20, 2009.

3.3. Monitoring Well Abandonment

The Monitoring Well Abandonment aspect of the work was implemented in accordance with Volume II, Appendix G, Section 7.0 – Monitoring Well Abandonment, of the approved April 4, 2008 RAWP. The work requirements were established by Specification(s) 02750 – Monitoring Well Abandonment and depicted on Plan(s) S-4 and modified by CCR 11. The general methods and materials were per submissions of work-related submittals F012 to assure that the technical specification and plan details met the design criteria/requirements. Upon completion of the Monitoring Well Abandonment aspect of work, the "as built" condition (well abandonment logs) is documented in

Submittal F013. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The Monitoring Well Abandonment aspect of the work was initiated on July 28, 2008 and substantially complete by August 1, 2008. Presented below are further details on the accomplishment of the work.

TtEC subcontracted Eichelbergers, Inc., a licensed drilling contractor, to perform the well abandonment activities at the Site. The wells were abandoned in accordance with Specification 02750 which required the use of pressure injected grout to seal the wells. The well driller utilized a tremie pipe to inject the grout into each well. The tremie pipe was lowered down the well to approximately three feet from the bottom and the grout was then injected into the void space within the filter pack and well screen. In one continuous operation the grout was injected into the well to fill it to the ground surface. Riser pipe, surface casings, and surface pads were then removed and disposed off-Site.

Nineteen monitoring wells and twelve piezometers were abandoned by the well driller. The well abandonment logs and information are provided in Submittal F013 – Well Abandonment Logs included in Appendix A.

3.4. Courtyard Area

3.4.1. Excavation of Courtyard Area Soils

The Courtyard Area Excavation aspect of the work was implemented in accordance with Section 5.4.4 of the approved April 4, 2008 RAWP. The work requirements were established by Specification(s) 02210 – Earthwork, 3.01 Excavation, F 5 – Courtyard Area Excavations and depicted on Plan(s) C-5. Modifications to this activity are documented by CCRs 14, 16, and 23. The general methods and materials were per submissions of work-related Submittal(s) F003, F004, F009, F014, F016, F021, F022, F029, F064, F092, F109S, F124S, F125S, F140S, and F141S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F008 and F019. Upon completion of the Courtyard Area Excavation aspect of work, the "as built" condition is documented in Submittal(s) F023 and F151S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The Courtyard Area Excavation aspect of the work was initiated on July 11, 2008 and substantially complete by July 16, 2008. Presented below are further details on the accomplishment of the work.

TtEC conducted a survey of the Site, to document existing conditions, prior to initiating excavation activities. The Courtyard Area was also surveyed and staked to indicate the required 1-foot and 2-foot cut areas to facilitate excavation and backfilling activities. Site baseline survey information is provided in Submittal F019, included in Appendix A.

The approach for excavation in the Courtyard Area was developed to maintain separation between “clean” and “contaminated” operations and to construct the clean construction road concurrent with installing the soil stockpile area while allowing for truck traffic to access the Site during early excavation/construction activities. CCRs 16 and 23 are related to modifications to traffic patterns on-Site.

Once the Courtyard Area was secured and surveyed, TtEC began soil removal activities. CY-1 was excavated first. Soil excavation was performed to a depth of 2 feet using an excavator. The excavated soil was loaded into dump trucks and transported to the temporary soil stockpile, to the south of Building 7, where it was placed on 6 mil polyethylene sheeting and covered with plastic sheeting. Approximately 10 cubic yards of material were excavated from CY-1.

Next, CY-2 (approximately 300 cubic yards) was excavated to a depth of 2 feet and the excavated soil was loaded into dump trucks for staging at the temporary stockpile area. The temporary stockpile area was used for CY-1 and CY-2 excavated soils since the construction of the temporary asphalt stockpile pad was not scheduled to be complete prior to excavation of this area, as per the USEPA approved April 4, 2008 RAWP. CY-2 excavated soils were staged in stockpiles underlain and covered by a 6 mil polyethylene liner. Waste characterization samples were collected from the stockpiles and analyzed for disposal parameters. Analytical results were provided by TtEC in Submittal F008. Excavated soil from CY-1 and CY-2 was then properly disposed of off-Site, based on the results of the waste characterization analysis.

The Milnor Street entrance was used for Site access during most of the CY-1 and CY-2 excavation activity; however, a UST was encountered midway through the excavation of CY-2, within the access road alignment [see Section 3.4.2 below for details of the UST actions]. TtEC submitted a Contractor Change Request (CCR), CCR-16, to use the Cottman Avenue entrance until the UST could be removed.

Once the CY-1 and CY-2 areas were completed, TtEC then began the shallow, one-foot Courtyard Area excavation, progressing into the Site from the Milnor entrance at the north toward the south and southwest. Material excavated from areas other than CY-1 and CY-2 found to contain PCB concentrations below 25 ppm were used in the Southern Area in accordance with the approved RAWP (i.e., at least 100 feet from the river and mudflats, at least 4 feet above the groundwater table, and beneath the specified depth of the soil cap). Excavated materials with PCB concentrations greater than 25 ppm were disposed off-Site.

During excavation of Courtyard Area soils, the railroad tracks and ties in the northeastern corner of the Site were removed using the excavator. Additional tracks and ties collected elsewhere on-Site throughout the duration of the project were also stockpiled in this area.

Stockpiled ties were disposed toward the end of Courtyard Area activities (i.e. one/two full truck loads versus several half truck loads) and tracks were shipped off-Site for recycling.

As construction progressed into the Site from Milnor Avenue, the Pennsylvania-licensed surveyor, Rettew Associates, surveyed the excavation areas to verify attainment of specified horizontal and vertical design limits depicted in the Design Drawings (Design Drawings S-4, C-4, and C-5 show the revised area of the Courtyard excavation and Design Drawings S-4 and C-11 show the revised area of the Courtyard to receive the 1-foot soil cover). A portion of the Courtyard Area was used as the construction support area for the duration of the project. Therefore the cover soil was not placed nor was the area vegetated until the support facilities were removed at the end of the project by Severson.

Site soils were used for preparatory grading purposes to the extent that the grading activities did not significantly disturb the surface. Imported fill was used as necessary to complete preparatory grading and to complete backfilling of the Courtyard Area.

In accordance with the design requirements, TtEC installed the geotextile demarcation layer prior to installing the final cover soil. CCR 14 documents the substitution of biodegradable stakes for stainless steel staples utilized to hold the geotextile in-place during installation.

As part of the preparatory grading activities, the excavations were backfilled to bring them up to existing grade. Clean fill from an off-Site source was used. Clean fill was provided by ABC Construction Co., Inc. and EME. The source of the material and analytical data classifying the fill as clean is provided in submittals F021, F022, F029, F109S, F113S, F121S, F125S, F135S, F140S, and F141S; all submittals can be found in Appendix A. The clean fill was placed in the upland excavations in approximate 12 inch lifts and properly compacted in accordance with the specifications. The compaction results are documented in TtEC's daily report dated December 3, 2008.

3.4.2. Courtyard Area UST and Vault Closure

Although the discovery of a UST in the Courtyard Area was not expected, the Courtyard Area UST and Vault Closure aspect of the work was implemented in accordance with relative portions of Section 5.4.8 of the approved April 4, 2008 RAWP. The work requirements were established by Specification(s) 02050 – Underground Storage Tank Closure. A specific work plan was prepared for these activities and approved by EPA and is included in Submittals F028 and F031. CCR 10 was provided by TtEC in response to the discovery of the UST and vault in the Courtyard Area and includes authorization to prepare a work plan for the removal of the UST and closure of the vault. Additionally, the construction data collected during this work was according to the design requirements

and is presented in Submittals F032 and F040. Upon completion of this aspect of the work, the photographs and final UST and Courtyard Area Vault Closure Report are documented in Submittals F049 and F082. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The field activities associated with the Courtyard Area UST and Vault Closure aspect of the work were completed on September 17, 2008. Presented below are further details on the accomplishment of the work.

USA Environmental Management, Inc. (USAEMI), a Pennsylvania-licensed UST subcontractor, was subcontracted by TtEC to remove an 8,000-gallon former heating oil UST and to close a concrete vault discovered in the Courtyard Area during excavation. USAEMI utilized Luzon to complete the field activities associated with the UST removal.

The UST was sampled, made inert, removed, and staged for off-Site disposal. All residual liquid, solids, sludges and residues were removed from the tank with a vacuum truck. Excavation sidewall and bottom samples were collected after the tank was removed as per Pennsylvania requirements. The results of the UST contents analyses are in Submittal F032 and analytical results of the post-excavation sampling are included in Submittal F040, in Appendix A.

The concrete vault also located in the Courtyard Area was closed in place, following the removal of residual liquids and cleaning. USAEMI used a lightweight concrete product, as per PADEP regulations, to close and seal the vault.

USAEMI provided a closure report (Submittal F082) certifying that the UST removal and vault closure was accomplished in accordance with appropriate regulatory requirements. All closure activities were performed in accordance with Construction Specification 02050.

In addition to the UST and vault encountered during the Courtyard Area excavation activities, another UST was discovered in the Courtyard Area, along Cottman Avenue during the Site mobilization. An investigation of this UST by USAEMI revealed that the UST had been abandoned in-place by others and was filled with concrete. The investigation also revealed that the concrete did not completely extend to the top of the UST and that a small amount of liquid was present in this space. In accordance with the USEPA approved work plan, USAEMI sampled and analyzed the liquid, removed and disposed of the liquid, and filled the UST with approximately 2 cubic yards of concrete. The field activities associated with this UST closure aspect of the work were completed on January 15, 2010. A copy of the Underground Storage Tank Closure Report prepared by USAEMI is provided in Appendix G.

3.5. Power Washing and Sealing of Courtyard Building 7

The Power Washing and Sealing aspect of the work was implemented in accordance with Section 5.4.2 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP. The work requirements were established by Specification(s) 09901 – Special Coatings and depicted on Plan S-4 and modified by CCR 99S. The general methods and materials were per submissions of work-related Submittal F011 to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data and daily observations performed by the Contractor and Engineer during this activity confirmed that the Work was performed in accordance with the design requirements. The Power Washing and Sealing of Courtyard Building 7 aspect of the work was initiated by TtEC on July 31, 2008 and was substantially complete by December 2008. Severson completed repairs to the sealant between October 24, 2009 and November 6, 2009. Presented below are further details on the accomplishment of the work

The Building 7 floor slab was power-washed and sealed after Courtyard Area cover soils were removed. All soils and loose debris were removed to create a surface that could be sealed. The surfaces were then washed with high pressure water. Rinsate was collected and transported to the water treatment system for treatment and discharge to the sanitary sewer, in accordance with the approved Philadelphia Water Department (PWD) permit. When the slab was sufficiently dry, TtEC applied an epoxy sealant, identified in Submittal F011, to complete this work.

Severson repaired epoxy surfaces that cracked due to expansion and contraction of the concrete surface. Materials used to address the cracked epoxy are discussed in CCR 99S.

During the power washing and sealing of Building 7, four vault areas were discovered and the USEPA requested that the lids be opened and the contents investigated, this work is addressed in CCR 69. Upon removal of the vault lids, the USEPA, Contractor, and Engineer observed that the vaults were empty. No further action was taken.

3.6. Southern Area

3.6.1. Soil and Sediment Management Pad

The Soil and Sediment Management Pad aspect of the work was implemented in accordance with Section 5.4.1.7 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP. The work requirements and pad layout were depicted on Plan(s) S-4, C-3, C-13, and C-21 but, were modified by the approved April 4, 2008 RAWP. TtEC initiated construction of the Soil and Sediment Management Pad on July 16, 2008 and it was substantially complete by July 30, 2008. TtEC maintained the

pad during the construction activities and made a significant repair to the pad on October 24, 2008. Severson upgraded and repaired the pad on August 7, 2009.

TtEC constructed an asphalt pad measuring approximately 155 feet by 155 feet for the temporary stockpiling of excavated soil and sediment from the Site. The pad was constructed of a 4-inch thick stone base layer overlain by 3 inches of sealed bituminous asphalt. A sump was located in the northwest corner of the pad to collect rain water and water from dewatering of the excavated sediments. Water collected on the pad was then transferred to the on-Site water treatment system. The pad was surrounded by an asphalt curb to prevent water from flowing off the pad.

Both contractors utilized pre-cast concrete jersey barriers to create bins to segregate the excavated soil and sediment during those activities. The stockpiled material was then sampled and analyzed and based on those results was transferred from the pad to trucks for either off-Site disposal or re-use on Site. For off-Site disposal, trucks entered the Site and remained on a clean, stone haul road that ran along the northern perimeter of the Exclusion Zone. The trucks were loaded at a small ramp located on the north side of the material staging pad.

Upon completion of the sediment dewatering activities, the pad was power washed, chip-sampled, and removed from the Site on December 3, 2009.

3.6.2. Sheet Pile Wall

The Sheet Pile Wall installation aspect of the work was implemented in accordance with Section 5.4.3 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP. The work requirements were established by Specification(s) 02375 – Steel Sheet Piles and depicted on Plan(s) C-26 through C-31 and modified by CCRs 5, 8, 12, 42, 54, 81, 87S, 88S, 90S, 93S, 94S, 96S, 101S, 103S, and 117S. The general methods and materials were per submissions of work-related Submittals F001, F030, F052, F095, and F106S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittals F027, F047, F051, F072, and F122S. Upon completion of the Sheet Pile Wall aspect of work, the "as built" condition was documented in Submittal F151S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The sheet pile installation aspect of the work, including installation of concrete deadmen, walers, tiebacks, and structural backfill was initiated on August 1, 2008 and was substantially complete by August 17, 2009. Presented below are further details on the accomplishment of the work.

Following completion of remedial activities in the Courtyard Area, the steel sheet pile wall was installed in the Southern Area by TtEC's subcontractor Midlantic. Prior to the

winter shut-down that occurred during the early part of 2009, Midlantic completed the installation of the steel sheet piles in Zones 1 through 3, installation of the waler around the exterior of the sheet pile wall, and installation of the concrete deadmen.

Sevenson completed installation of the Sheet Pile Wall with installation of the steel rod tie-backs, application of the final epoxy coating to the tie back/sheet annulus and sleeve washer, repairs to the waler, and installation of backfill behind the wall.

During the installation of the sheet pile wall, turbidity monitors and controls were in place as described in Section 3.8.2 below.

3.6.2.1. Sheet Pile Layout

TtEC's Subcontractor, Midlantic, installed the steel sheet pile bulkhead in locations marked on Remedial Design Drawings (C-26 – Sheet Pile Wall General Plan & Notes; C-27 – Sheet Pile Wall Partial Plan, Zone 1; C-28 – Sheet Pile Wall Partial Plan, Zone 2; C-29 – Sheet Pile Wall Partial Plan, Zone 3 and C-30 – Sheet Pile Wall Plan) and described in Construction Specification 02375 – Steel Sheet Piles. The steel sheet pile wall was constructed at the southwestern corner of the Site, adjacent to the Delaware River. Layout of the sheets, walers, tiebacks, and deadmen was conducted by TtEC's surveying Subcontractor, Rettew as shown in Submittal F 151S of the "as built" drawings in Appendix E.

3.6.2.2. Sheet Pile Installation

The following equipment was used for installation of sheet pile:

- 100 Ton Crawler Crane, with a minimum boom length of 130 feet;
- Ape 200 Hammer with power pack;
- Excavator (for removal of obstructions);
- Two Lincoln 400-amp Welding Machines; and
- Three Burning Outfits.

Materials used include AZ 19-700 ASTM A572 GR 50 x 35', AZ 26 ASTM A572 GR 50 x 45', and AZ 26 ASTM A572 GR 50 x 55'. All sheeting materials were coated with Bar-Rust 235 Multi-Purpose Epoxy Coating in accordance with Construction Specification 09905.

A rack system consisting of two (2) vertical H-piles and one (1) horizontal H-pile were erected at the starting point (northeast terminus of Zone 3 wall) with the horizontal pile being at approximate elevation +10.0 and in line with the layout for the sheet pile wall. A pair of sheets were picked up and driven to a top of sheet elevation of approximately

+15.0 using the referenced vibrating hammer; this pair was temporarily secured to the rack. Subsequent pairs of sheet piles were locked into the previously driven sheet piles and driven to the same approximate top of sheet elevation. (As necessary, the sheet pile was temporarily secured to the rack to prevent sheet pile from being driven with subsequently driven sheet pile pairs.) Once the sheet pile was driven to the end of the rack, the rack was shifted to the next adjacent area of work and the driven piles were then driven to the specified tip elevation. These methods were repeated from start to finish during the installation of sheet piles starting at the northeast corner of Zone 3 and continuing in a southerly and westerly direction through Zone 3, Zone 2 and Zone 1.

Subsurface materials at the project Site included clay, silt and alluvial sand and gravel. Obstructions encountered during driving operations were reported to the Supervising Engineer, Malcolm Pirnie. When sheeting did not clear obstructions after reasonable efforts were made by driving crews, decisions as to how obstructions would be handled were made with the Supervising Engineer from Malcolm Pirnie, in accordance with guidance provided by the design engineer, AMEC, in its memo dated September 5, 2008. When an obstruction was encountered by a sheet pile, the sheet pile was pulled and a chisel beam was driven in an effort penetrate the obstruction. The sheet pile was then driven to the appropriate depth or until refusal.

3.6.2.3. Waler Installation

CCR 12 modified the method of connection of the waler to the sheet pile wall. TtEC submitted this CCR to change the bolt pattern depicted on Drawing C-31 Section A-A to longer bolts that extend through the waler. The CCR was approved by Malcolm Pirnie and the design engineer, AMEC.

Survey crews established proper elevations on the sheets to receive walers. Small clips were welded to the sheets for the purpose of leveling the walers to the sheet pile wall. The welded clips were cleaned, chipped free of slag, and coated with epoxy tar prior to installation of the walers. The walers were installed on the face of the offshore sheet side of sheets. Once installation of the walers was complete, excavation of SA-4/5 was initiated.

During Phase 2 of the remedial action construction activities, cracks were observed in the waler along the sheet pile wall at the transition from the river to the Mudflat Area. Severson submitted CCRs 93S, 94S, 101S, and 103S in response to this issue. CCR 93S was a request for clarification from the design engineer of the appropriate method of repair of the waler. AMEC approved the use of splice plates. CCR 94S was a request for clarification from AMEC about means and methods for replacement of a section of waler in Zone 2. AMEC expressed preference for use of welds for this repair. CCR 101S provides the method of repair to the waler in Zone 2 based on AMEC's

recommendations. CCR 103S was a proposal from Severson to add a stiffening plate to the waler. Malcolm Pirnie and AMEC approved this CCR. The repairs identified in these CCRs were made during Phase 2 of the remedial action by Severson.

Once the walers were installed, survey crews laid out grades for excavation and placement of pre-cast concrete deadmen blocks. TtEC then excavated a trench to the specified elevation and Midlantic installed the pre-cast concrete deadmen in the excavated area. Survey crews aided in alignment of the pre-cast blocks and verified that they were installed in the specified locations per sheets C-26 to C-30.

3.6.2.4. Tieback Installation

Severson completed installation of the Sheet Pile Wall by installing the tiebacks. Prior to the start of the tieback installation operation, Severson had surveyors mark out the exact location of the holes that had to be cut into the sheet piles to allow for the installation of the threaded tieback rods. Once all of the holes were marked, a crew mobilized to cut the access holes for the tie backs using various cutting tools and torches. While the tie back holes were being installed, a second crew, with the assistance of an equipment operator and a laborer, began installing the tiebacks and PVC sleeves as required (sleeve diameter modified by CCR 81).

Severson installed the rods as single units, using the land based crane to reach past the Sheet Pile wall to feed the rods through the holes. Once the rod was passed through the wall, the rod was fed through schedule 40 PVC 3" sleeves and the hole in the deadmen and secured in accordance with the design, as shown on Drawing C-30. Severson completed the installation of the tiebacks to the ½-inch fitted stiffener plates, the 2-inch plate, and the 1-inch fabricated angle on the outside of the sheets as shown in Section B-B on Drawing C-31. At this time, a seal was installed around the annulus in the sheets with high build epoxy from inside and outside the sheets. This process was repeated as appropriate until all of the tiebacks were installed.

During the installation of the tiebacks, it was observed that the tieback spacing as constructed was slightly different from that depicted in the design drawings (Drawing C-28). The design drawing indicates a spacing of one tieback per every other sheet pile pair; however, in some locations within Zone 2 of the sheet pile wall the tieback spacing is slightly greater. Based on these observations, Malcolm Pirnie requested that AMEC provide its opinion of the tieback locations as constructed. In its memo dated August 28, 2009, AMEC provided the results of its structural analysis of the wall and concluded “that it is acceptable to proceed with construction of the wall as constructed. No repairs will be required to adjust the irregular spacing of the tieback installation.” The memo is included in Appendix I.

Once the tie back crew proceeded far enough ahead, a back fill crew was mobilized to start installing structural fill in compacted 12" lifts as required behind the sheets per Specifications 02210 and 02375.

3.6.2.5. Backfilling

Structural backfill was placed behind the sheet pile wall following the installation of the tiebacks. The structural backfill was placed in lifts and compacted with low ground pressure (LGP) equipment. CCR 90S provides clarification of the compaction requirement for this backfill. Essentially, the design engineer approved relief for compaction of the first lift to 1 foot above the mean high water due to the fluctuation of the tidal cycle.

3.6.2.6. Monitor and Repair

Monitoring of sheet pile wall deflection took place following construction of the wall and during the installation of the structural backfill behind the wall. Surveys monitored the x, y, and z dimensions of the sheet pile wall in accordance with Construction Specification 02900. The sheet pile wall was inspected for corrosion and any necessary repairs were addressed by TtEC and Severson. Inspections checked to verify that any erosion of the front and sides of the wall were not jeopardizing the integrity of the wall. Any riprap placed around the wall was inspected for stability and to verify that it remains intact. Data was submitted to Malcolm Pirnie via email and was evaluated by AMEC periodically.

3.7. Excavation of Southern Area

3.7.1. Excavation and Backfill – Areas SA-2 and SA-3

The Excavation and Backfill – Areas SA-2 and SA-3 aspect of the work was implemented in accordance with Section 5.4.4 of the approved April 4, 2008 RAWP. The work requirements were established by Specification(s) 02210 – Earthwork and depicted on Plan(s) C-6, C-7, and C-16 and modified by CCRs 31 and 33. The general methods and materials were per submissions of work-related Submittal(s) F021 and F037 to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F024, F025, F026, and F027. Upon completion of the Excavation and Backfill – SA-2 and SA-3 aspect of work, the "as built" condition is documented in Submittal F033. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The SA-2 Excavation aspect of the work was initiated on August 12, 2008 and verified to be complete on September 23, 2008 by field survey. The SA-3 Excavation aspect of the work was initiated on August 13, 2008 and was verified to be complete on September 23, 2008 by field survey. Presented below are further details on the accomplishment of the work.

SA-2 was excavated in one cut to Elevation 10, moving from south to north. The excavator was located at the top of the excavation at Elevation 15 to load trucks for transport to the soil material management pad. The side walls were cut to the slopes shown on Design Drawings C-6 and C-7. The upgradient side of the excavation was bermed to prevent surface run off from entering the excavation. A ramp was cut into the sidewall on the north side of the excavation to gain access to the excavation for sampling and backfilling. Workers and equipment were kept away from the side slopes to prevent injury from slope failure. The material excavated was placed in trucks, which entered the Elevation 10 bench via the access ramp. Traffic routes were established daily to minimize the distance for trucks to back up and minimize the potential for encountering other traffic hazards. Excavation along the eastern edge of the deep excavation area was also performed by placing the excavator on the existing Elevation 15 ground surface east of the excavation.

Once the survey, performed by a PA licensed surveyor (Rettew), confirmed the excavation was complete, the excavated area was prepared for backfilling. The material was trucked down the ramp and deposited starting along the west edge of the deep excavation. The material was spread in one-foot lifts using a dozer. Each lift was compacted using a roller in accordance with Construction Specification 02210. The “as built” condition is shown on Sheet 3 of 3 of the drawings included in Submittal F033 in Appendix A.

SA-3 was excavated in two cuts, moving from southwest to northeast. On the first cut, the excavator was located at the top of the excavation at Elevation 13. The excavator loaded trucks that transported the material to the soil material management pad. The side walls were cut to the slopes shown on Design Drawings C-6 and C-7. The upgrade side of the excavation was bermed to prevent surface run off from entering the excavation. To gain access to the excavation for further excavation, a ramp was cut into the side wall on the west side of the excavation. Workers and equipment were kept away from the side slopes to prevent injury from slope failure. The excavator was placed on the Elevation 7 bench where it excavated the second cut down to Elevation 1, moving from south to north.

During excavation of SA-3, an unknown green liquid seeped into the excavation. A sample of the unknown substance was collected and analyzed for volatile organic compounds (VOCs), semi-volatile compounds (SVOCs), metals (total and dissolved), pesticides and PCBs, ethylene glycol and hexavalent chromium. The analytical results revealed constituent concentrations below applicable standards and the USEPA concurred that the excavation could be backfilled. Analytical results are provided in Submittal F026.

Once the survey, performed by a PA licensed surveyor, confirmed the excavation was complete, it was prepared for backfilling. Backfill below the water table included stone

and crushed concrete until above the water table. Imported clean soil fill was utilized to backfill from the stone/crushed concrete elevation to grade. The material was trucked down the ramp and deposited, starting along the northeastern edge of the deep excavation. The material was spread in one-foot lifts using a dozer. Each lift was compacted using a roller in accordance with Construction Specification 02210. The “as built” condition is shown on Sheet 3 of 3 of the drawings included in Submittal F033 in Appendix A.

3.7.1.1. Excavation and Backfill – Areas SA-4/SA-5

The Excavation and Backfill – Areas SA-4/SA-5 aspect of the work was implemented in accordance with Section 5.4.4 of the approved April 4, 2008 RAWP. The work requirements were established by Specification(s) 02210 – Earthwork and depicted on Plan(s) C-7 and C-15 and modified by CCRs 55 and 78. The general methods and materials were per submissions of work-related Submittals F021 and F087 to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F056, F059, F060, F063, F062, F067, F068, F069, F074, F075, F076, F079, F080, F085, F086, F088, F089, F093, F094, F096, and F102. Upon completion of the Excavation and Backfill – Areas SA-4/SA-5 aspect of work, the “as built” condition is documented in Submittal F091 and in a technical memorandum from J. Vitale to S. Fang dated December 24, 2008, included in Appendix I. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The SA-4/SA-5 aspect of the work was initiated on October 20, 2008 and substantially complete by December 24, 2008. Presented below are further details on the accomplishment of the work

TtEC first excavated unsaturated soil in the E-1, E-2, E-3 and E-6 areas to Elevation 5 or Elevation 7 in the case of E-1, to provide a stable platform for sampling and excavation of sidewall soils.

After the first cut was completed, TtEC accessed this platform through a wide ramp from the surface into the excavation from the eastern side of SA-4/5 to perform the second cut. Due to the potential requirement to extend the southwestern sidewall between previously existing wells MW-7 and BP-7 toward the Delaware River and sheet pile wall as a result of sidewall sampling or oil seepage, the second cut began by excavating the southwestern face in a single pass. This single pass exposed the surface to the required depth of one foot below groundwater to obtain verification samples and allow for visual verification. The depth of groundwater was established prior to commencement of excavation via monitoring well gauging and confirmed through excavation of a test-pit within the SA-4/5 excavation area. The groundwater elevation was determined to be 1.77 ft above mean sea level (MSL)

Excavation sidewall sampling and analysis was performed in accordance with the RAWP and the results indicated that additional excavation was required in the vicinity of sample MB-SA45-A-7-13. The area was excavated and another round of confirmatory samples were collected and analyzed.

Based on the results of the second confirmatory sample, the southwestern face of the excavation was verified to be clean and excavation proceeded in passes across the Site from west to east. The bottom of the excavation dropped down to five feet below groundwater in E-7. The excavation depth was measured by marking the excavator boom to the required depth and placing the excavator bucket on the floor of the excavation and verified by the surveyors prior to backfilling.

Once the excavation of SA-4/5 was completed, TtEC removed as much oil as practicable from the surface of the water within the excavated area. TtEC utilized a vacuum truck and sorbent pads and booms to remove the oil from the surface of the water.

Approximately 300 gallons of oil and water were pumped to a plastic holding tank on-Site and allowed to settle. After settling, approximately 50 gallons of oil was transferred from the tank to a drum for off-Site disposal. The remaining water was treated in the on-Site water treatment system and discharged in accordance with the PWD permit.

Following the removal of the oil from the SA-4/5 excavation area, TtEC conducted the 72-hour stabilization/inspection period in accordance with Construction Specification 02220. Based on the observations made at the conclusion of the stabilization period, it was determined that flow of oil from the excavation sidewall did not exceed 1/16 of an inch and TtEC backfilled the excavation. Please see the attached technical memorandum (Appendix I) of the SA 4/5 closure that was prepared by Malcolm Pirnie and forwarded to the USEPA on December 24, 2008 relative to the Group meeting the obligations of Section 5.4.9 of the approved RAWP and the requirements of ESD #2 to commence the backfilling operations. The Group aggressively removed oil from the excavation using reasonable and practical methods consistent with the approved Revised Remedial Plan; however, the Group decided to install the interceptor trench as an enhancement to the remedy and resolve USEPA concerns relative to oils.

A ramp was cut in the east side of the excavation to allow backfill material to be trucked to the edge of E-7. E-7 was backfilled with clean rock and crushed concrete to the top of groundwater. Backfilling of SA-4/5 was completed using clean certified imported fill. During backfilling, chipped/grubbed materials were mixed with and spread in the uppermost fill in a less than 3-inch layer in the area receiving the soil cap at least 12 inches below the cap as per Construction Specification 02110.

As SA-4/5 was backfilled, TtEC installed the deadmen to provide permanent structural support for the sheet pile wall.

3.7.2. UST Closure

The UST Closure aspect of the work was implemented in accordance with Section 5.4.8 of the approved April 4, 2008 RAWP. The work requirements were established by Specification 02050 – Underground Storage Tank Closure and depicted on Plan(s) C-4 and C-7. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F049 and F054. Upon completion of the UST Closure aspect of work, the “as built” condition is documented in Submittal F091. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The UST in SA-4/SA-5 was removed from the Site on October 22, 2008. Presented below are further details on the accomplishment of the work

Prior to beginning excavation of SA-4/5, TtEC demolished and removed concrete and the 4,000-gallon former oil storage UST. TtEC’s Pennsylvania-licensed UST subcontractor, USAEMI, removed the UST and arranged for its transportation and disposal. TtEC removed the concrete pad using a ram hoe and excavator. The concrete was chipped and sampled to verify suitability to be replaced in SA-4/5 during backfilling. The analytical results of the concrete chip samples are provided in Submittal F054. The tank was removed, made inert and staged for off-Site disposal. The UST subcontractor provided a closure report (Submittal F082) certifying that the UST removal was accomplished in accordance with all regulatory requirements. All closure activities were performed in accordance with Construction Specification 02050.

Prior to removal, the UST was exposed and observed to be filled with a small amount of liquid on top of flowable fill material. Approximately 100 gallons of liquid were removed from the tank and treated as construction water which was collected and treated on-Site in the construction water treatment system. The UST was then ripped open with an excavator and the flowable fill material was removed from the UST. The material removed from the UST was initially placed on plastic next to the excavation and then moved to the material staging pad for off-Site disposal.

The atmosphere within the UST was confirmed to be inert and the interior of the UST was then cleaned by TtEC’s subcontractor. The tank was then removed, labeled and disposed of as scrap metal. TtEC inspected the tank upon removal to determine if it had any visible leaks and photographed the UST as per the specifications. The photographs are included in Submittal F049.

3.7.3. Southern Area Cap

The Southern Area Cap aspect of the work was implemented in accordance with Section 5.4.4 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 44-45. The work requirements were established by Specification(s) 02210,

02273, and 02910 and depicted on Plan(s) S-4, C-2, C-4, C-8, C-9, C-11, C-12, C-20, and C-25 and modified by CCRs 49, 102S, 104S, 105S, 108S, and 112S. The general methods and materials were per submissions of work-related Submittals F003, F004, F016, F021, F022, F029, F064, F092, F105S, F109S, F111S, F116S, F120S, F123S, F124S, F127S, F128S, F140S, and F141S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F153S. Upon completion of the Southern Area Cap aspect of work, the “as built” condition is documented in Submittal F151S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The Southern Area Cap aspect of the work was initiated by TtEC, who performed preparatory grading of the existing surface beneath the cap, in October 2008. Severson completed the Southern Area Cap in January 2010. Presented below are further details on the accomplishment of the work.

TtEC completed upland excavation during the early phases of work. SA-2 and SA-3 were excavated and backfilled with certified clean imported fill by October 1, 2008. SA-4/5 was excavated and backfilled with crushed concrete to one foot above the depth of groundwater and with certified clean backfill by January 2009. TtEC initiated the subgrade preparation activities prior to the winter shutdown in February 2009.

Severson then completed the subgrade preparation by placing approved sediment (See Section 3.8 Sediment Excavation – Delaware River and Mudflat Area) from the mud flat and deep water excavation areas in the Southern Cap Area. Severson used bulldozers to ensure that the required 1% slope was achieved on the subgrade prior to the installation of the geotextile and import of soil for the 2’ thick cover system meeting the requirements set forth in Construction Specification 02210 and subgrade elevations presented on Sheet C-6 that was modified by AMEC on September 25, 2009 to accommodate the LNAPL trench design.

Once the subgrade was approved and accepted by the engineer, Severson then initiated the installation of the geotextile and the import and placement of clean fill material in lifts as required. Geotextile meeting the requirements set forth in Construction Specification 02273 was installed in localized areas on-Site as the cover soil was being imported to the Site. The geotextile was unrolled and affixed to the ground with landscaping staples and sandbags. The seams of the geotextile rolls were overlapped at a minimum of 18 inches, instead of being stitched or heat seamed, and inspected prior to the installation of the cover soil. CCR 105S documents the change in procedure for the installation of the geotextile, relative to the seams. Cover soil materials were provided by ABC Construction (ABC) of Bensalem, Pennsylvania and Excavating, Materials and Equipment (EME) of New Egypt, New Jersey. The material was amended as appropriate

and adhered to the contract specifications. Cover soil material was required to meet a clean soil standard that was provided by the USEPA Region III Biological Technical Assistance Group (BTAG) and was included in Appendix B of the Construction Specifications. Prior to being imported to the Site, the cover soil material was sampled and analyzed in accordance with the requirements included in the Construction Specifications. The analytical results were screened against the BTAG requirements and submitted to the USEPA for approval. Once approved by the USEPA, the cover soil was delivered to the jobsite in the supplier's trucks. Severson directed trucks carrying clean imported fill over previously compacted clean fill to their desired dump locations in order to mitigate cross contamination. Severson utilized the services of a spotter to assist each truck as it backed into position to be dumped. Each truck dumped the approved cover soil in place where a bulldozer was used to spread the soils. As the fill placement advanced, soil was placed in 12-inch lifts and compacted to 90% of the maximum dry density as determined by the Standard Proctor Compaction Test. As necessary, Severson stockpiled cover soil material on-Site and transported it using a rubber tire front-end loader to be dumped where needed. Severson maintained the decontamination pad while the exclusion zone was in place and continued to maintain the scrubber pad at the Site entrance to limit tracking of material onto the local roadways. Severson also contracted TCM Contractors to conduct street sweeping along Milnor Street and Cottman Avenue to reduce migration of dirt off-Site.

Following the installation of the soil cap, perimeter fence, and erosion and sediment control measures such as straw blankets and coir logs, Severson installed a seed mix meeting the requirements of Construction Specification 02910 on the upland, capped portions of the Site. The seed mix and mulch with tackifier was installed with a hydroseeder pulled by a pick-up truck.

3.8. Sediment Excavation - Delaware River and Mudflat Area

The Sediment Excavation aspect of the work was implemented in accordance with Section (s) 5.4.5 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 18-29. The work requirements were established by Specification(s) 02900 and depicted on Plan(s) S-4, S-5, C-32, C-33, C-34, C-35, C-36, and C-37 and modified by CCRs 18, 34, 36, 53, 58, 59, 100S, and 104S. The general methods and materials were per submissions of work-related Submittal(s) F002, F003, F004, F005, F006, F020, F035, F042, F050, F051, F104S, F107S, and F108S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F111S, F112S, F116S, F119S, and F123S. Upon completion of the Sediment Excavation aspect of work, the "as built" condition is documented in Submittal F129S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The Sediment Excavation

aspect of the work was initiated in the Mudflat Area on August 17, 2009 then progressed to the Deep Sediment Area on September 16, 2009 and both areas were verified to be complete on December 3, 2009. Presented below are further details on the accomplishment of the work

Sevenson performed sediment excavation operations in the Delaware River and the adjacent Mudflat Area.

3.8.1. Site Preparation

Prior to the commencement of sediment removal and temporary sheet piling installation, Sevenson performed the following tasks:

- Contacted PA One Call to ensure that no underground utilities were located within the excavation or sheeting foot print;
- Contacted the USCG to discuss project notification form and need to obtain Private Aid to Navigation permit for the temporary sheet pile wall;
- Installed (4) turbidity monitors in separate locations as directed by the USEPA;
- Performed (7) days of turbidity monitoring utilizing the previously deployed monitors;
- Performed an initial topographic and bathymetric survey to confirm baseline sediment elevations prior to the start of work;
- Deployed turbidity curtain and oil booms around the perimeter of the Mudflat work area;
- Installed temporary sheeting, silt curtains, oil booms and aids to mariners (floating marker buoy with flashing beacon lights, signage, etc) around the perimeter of the deep and mudflat work areas (see 3.8.2.2 Temporary Sheet Pile Wall);
- Decontaminated the soil management pad via pressure washing, repaired the curbing, and resealed the pad converting it into the sediment management pad which was divided by jersey barriers into three sediment management bins;
- Established access routes from the sediment removal area which were utilized by the dump trucks that transported the excavated sediment to the 155' x 155' sediment management pad / material handling pad;
- Established a work zone around the 280 ton crawler crane; and
- Mobilized multiple work boats equipped with oil booms, absorbent pads, gaff hooks, and any other equipment that was necessary to expedite the capture and cleanup of any oil sheen or "rose buds" that were encountered as a result of this work. These vessels were also utilized during the surveying process once the removal of sediment was complete as well as visual verification procedures.

While the Site was being prepared, a State of Pennsylvania licensed land surveyor, Rettew Associates, surveyed the permanent sheet pile wall that was previously installed. After the initial survey was completed, Severson's quality control personnel conducted daily monitoring of the sheets to monitor and document any movement that may have occurred during the river work activities. The results of the daily sheet pile monitoring were recorded in Severson's daily reports. If a daily inspection provided evidence of possible movement, Severson immediately notified the on-Site engineer as well as Rettew to verify the movement. Severson utilized the Site quality control personnel to conduct the necessary survey checks during each operation.

3.8.2. Pre-Excavation Turbidity Controls

The Pre-Excavation Turbidity Controls and Turbidity Monitoring aspects of the work were implemented in accordance with Section(s) 5.4.5, pages 5-31 and 5-32 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 6 through 10. The work requirements were established by Specification(s) 01411 – Turbidity Monitoring and depicted on Plan(s) C-35 and C-37 and modified by CCRs 18, 36, 40, 58, 59, 85, and 97S. The general methods and materials were per submissions of work-related Submittal(s) F002, F005, F006, F042, F050, and F104S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in the Contractor's Daily Reports. Upon completion of the Pre-Excavation Turbidity Controls and Turbidity Monitoring aspects of work, the activities were documented in Submittal F147S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations.

Turbidity curtains were installed by TtEC around the sheet pile construction area in Zones 2 and 3 between July 18 and 21, 2008. An additional turbidity curtain was installed on July 28 and 30, 2008 prior to commencing work on the sheet pile wall. The permanent turbidity curtain and oil containment booms were installed in the work zones between September 15 and 23, 2008. Additional oil containment boom was installed outside the turbidity curtain on October 24, 2008. Between December 12 and 23, 2008, a semi-permeable turbidity curtain was installed to replace the existing turbidity curtain; the old turbidity curtain and booms were removed on December 29, 2008. Turbidity monitoring equipment was deployed on October 16, 2008 to begin collecting continuous, pre-excavation background data in anticipation of excavation activities; a fourth turbidity monitor was installed on November 24, 2008.

Turbidity monitors were installed by Severson in the Delaware River on July 25, 2009. Severson completed the installation of turbidity curtains and oil containment boom in the excavation areas on August 14, 2009. Severson began installation of the super-silt fence in the Mudflat Area on August 4, 2009 and completed it by August 17, 2009. Severson

then initiated construction of the temporary sheet pile wall on August 17, 2009 and completed it by September 16, 2009. Presented below are further details on the accomplishment of the work

Prior to excavating PCB containing sediment from the deep and mudflat work areas, Severson installed turbidity control and oil containment measures in the Delaware River work zones. These measures included the installation of a turbidity curtain, oil containment boom, oil sorbent booms, and a temporary sheet pile wall.

Due to the velocity of currents in the Delaware River exceeding two (2) to three (3) feet per second, which were above Severson's recommended threshold to install silt curtains as the primary form of turbidity containment, Severson maintained control of turbidity during the excavation and backfill operations of the deep area by utilizing a temporary sheet pile wall as the primary containment in the work area. Severson also installed turbidity curtains with oil absorbent boom located outboard of the sheet pile wall as means of secondary containment. The silt curtains were installed and adjusted with skiffs on the water.

In order to prevent the migration of sediments and oil sheens from the Mudflat Area out into the river during high tide, Severson installed an enhanced silt fence, similar to the super filter fabric fencing utilized at the Site, around the Mudflat Area. The enhanced fence extended from the shoreline at the northern end of the Mudflat Area around the western and southern boundaries where it was temporarily connected to the existing, permanent sheet pile wall. This enhanced fence consisted of steel fence posts, 6' high chain-link wire, and silt fence fabric. The fence was tied into the shoreline and the sheeting by sandbags and oil sorbent boom to prevent the potential for leaks or excursions. In addition, a 4' high turbidity curtain, an absorbent oil boom, and a hard oil boom were also installed just outside this fence in order to provide additional controls for any potential turbidity and/or oil sheen. To ease the sediment excavation operations, the enhanced silt fence was installed 5 feet from the sediment excavation limits.

Turbidity controls were deployed prior to any sheet pile or excavation activities taking place. Curtains were laced together on shore and pulled into the waterway with work boats. The work boats towed the curtain into position where it was anchored in position. After the curtain was anchored, the skirting was released. At this point the curtain was functional. Both absorbent and hard oil booms were then deployed along the alignment of the curtain. Oil booms were inspected daily and replaced when they became oil soaked. Booms that were removed from the waterway were transported to shore and staged for proper off-Site disposal. The turbidity curtain was also inspected by the quality control manager at a minimum frequency of twice a day and repaired as necessary. As the oil saturated boom was replaced and removed, it was handled in a manner that did not contaminate any areas that had been deemed clean. The saturated oil boom was placed in

a roll-off container and was properly disposed off-Site. During the daily inspections, the quality control manager (Sevenson) also visually inspected the water outside the turbidity curtain to be sure that no visible plume was being released past the curtain. The workforce was instructed to report any deficiencies seen in the curtain or any visible plume outside of the curtain in addition to the inspection performed by the Site Quality Control Manager (Sevenson). If any deficiencies in the curtain were found or any visible plume was seen outside the curtain, the workforce immediately notified Sevenson supervision of their findings and the Site Superintendent immediately corrected the problem.

3.8.2.1. Turbidity Monitoring

Sevenson performed turbidity monitoring during Sediment Excavation as described in the Construction Specification 01411. Sevenson monitored turbidity for seven days prior to Delaware River activities as specified in the Remedial Design. These data were used to compare the on-Site (work zone) turbidity results to the off-Site (upgradient and downgradient river locations) results during remediation activities. A decision matrix for notification and/or work zone corrective actions was developed (and approved by the USEPA) which specified turbidity levels at 100 feet beyond the work zone relative to the real time turbidity conditions of the river's background results. Real-time turbidity monitoring continued throughout the duration of sediment excavation to verify the effectiveness of controls. Real-time monitoring data from the work zone was compared to data collected from a background data point outside the work area.

The turbidity monitoring, locations reflective of USEPA suggestions of December 18, 2008, was performed using four fixed YSI 6820/6920 V2 Turbidity Monitors (Submittal 104S). NexSens OBS-3 Turbidity Monitors were kept for use as back-ups in case a YSI unit failed. Monitoring locations consisted of: one upstream background turbidity monitor, one upstream work zone turbidity monitor, one downstream work zone turbidity monitor and one downstream background turbidity monitor. The monitors were positioned in the exact location of the coordinates that were received from the USEPA. The YSI turbidity monitors were set 3 feet from the river bottom and were anchored to the river bed so that the distance from the bottom would not fluctuate with the tide cycle.

The YSI turbidity monitors met the performance criteria as established by USEPA method 180.1. The first upstream turbidity monitor was 1 mile upstream and placed within 100-300 ft. offshore to measure the real-time background turbidity level. The location was on the same side of the river as the Site, in the main flow of the river outside of the tidal influence of the Site vicinity. The upstream work zone, downstream work zone and background locations proposed by the USEPA (December 18, 2008) served as the basis for the turbidity monitoring locations during background monitoring and while the construction activities were performed. Sevenson performed background monitoring

7 days in advance of the start of sediment excavation. This data was used to establish a background level suitable for the project and set the standard for any readings in excess of the project standards. Real time turbidity monitoring continued throughout the duration of sediment excavation to verify the effectiveness of controls. Real time monitoring data at three locations were collected and compared to data collected from a background point outside of the work area. If turbidity monitoring data in the work zone exceeded background parameters as specified in Construction Specification 01411, work processes were evaluated and adjusted, or suspended, as necessary, until an effective modification was implemented. In addition, if turbidity readings were in excess of threshold limits in excess of 35 NTUs or 15% more than the background turbidity (upstream) monitor (whichever was greater) outside of the turbidity curtain for more than 60 minutes, Severson would notify Malcolm Pirnie. Malcolm Pirnie then identified an appropriate corrective action in accordance with the USEPA approved decision matrix.

Each monitor was calibrated based on the manufacturers' recommendations which included preventative maintenance precautions, trouble shooting, and the calibration schedule. In the event that the deployed turbidity monitors produced skewed results and visual turbidity was present in around the work area, Severson utilized a hand held turbidity monitor to obtain data. Severson inspected the deployed meters and cleaned and recalibrated as necessary. The calibration and inspection logs are located in Severson's Daily Reports in Appendix C.

During Excavation and Backfill of the Deep Sediment and Mudflat Areas, and Sub-Aqueous Cap Placement Operations, turbidity monitoring was continuous, recording data 24 hours a day, 7 days a week. The sampling frequency was one data point every 3 minutes. This data point was the average of the previous 3 minutes. Additionally during the presence of Severson staff on-Site, the computer collecting the data was audited by personnel on an hourly basis. If the action levels relative to the background turbidity value were exceeded during the excavation phase of the operation, Severson took immediate action to reduce the amount of sediment being re-suspended.

Throughout the duration of the project, it became apparent that turbidity would spike during tidal transitions (high to low tide and again during the transition from low to high tide). Such fluctuations were observed regardless of work activities and are attributed to the natural conditions of the river. All recorded exceedences at the site and in the downstream turbidity meter were the result of upstream turbidity entering the working zone or from the fouling of individual turbidity monitors. At no point did turbidly exceedences cause construction to cease. NexSens turbidity monitoring reports can be found in TtEC and Severson's Daily Reports located in Appendix C.

3.8.2.2. Temporary Sheet Pile Wall

The Temporary Sheet Pile Wall aspect of the work was implemented in accordance with Pages 10 through 17 of the approved July 6, 2009 RAWP. Presented below are further details on the accomplishment of the work

Since the current of the Delaware River has a velocity that exceeded the 2-3 feet per second or “upper velocity threshold”, the use of a conventional silt curtain was marginally effective in adequately containing turbidity that would be generated during sediment removal operations in the deep-water excavation area. Additionally, the conventional silt curtain impeded the placement of non-woven fabric and backfill. As such, in order to control the turbidity, prevent any excursions of sediment outside of the designated work area, and to aid in non-woven fabric installation, a temporary sheet pile wall or turbidity wall was installed.

The temporary wall, designed by Glynn Geotechnical Engineers (GGE), consisted of paired AZ 17 /19 - 700 steel sheet piling supported by composite king piles (composite HP 12 x 74 / paired with AZ 18/26 sheet piling or equivalent materials) installed at approximate 16.5 ft intervals along the wall. The king piles were driven to a toe depth of up to 30 ft into the sediment, depending on the mudline elevation, while the adjacent “curtain” wall of paired sheets were driven to a minimum depth of 6 to 12 inches into the sediments. The turbidity wall also contained a light “hanging” waler system along the top of the intermediate sheet piling between the king piles to limit any deflection on the sheets. Intermittent overflow weirs protected by geotextile fabric were installed to balance the hydrostatic pressure.

3.8.2.3. Temporary Sheet Pile Installation Equipment

In order to install the temporary sheet pile, Severson mobilized the following equipment to conduct the operation:

- 280 Ton Crawler Crane (Land Based);
- 150 Ton Crawler Crane (Floating Crane barge);
- Two Floating Work Barges (Equipment and Material Staging);
- APE Vibratory Hammer with power pack;
- Rubber Tire Loader (Unload sheet piling);
- Man-lift (As necessary);
- Crane Mats (As necessary);
- Portable Welding Machine;
- Work Boat with USCG required safety equipment;
- Personnel Transportation Boat with USCG required safety equipment; and

- Torches and other hand tools as necessary.

Sevenson utilized a combination of the 280 ton crane on shore and the 150 ton crane on the spud barge to facilitate in the installation of the temporary sheet pile wall.

Prior to installing the temporary sheeting, a survey crew laid-out the alignment of the wall. The wall was situated approximately 5' outside the perimeter of the deep water excavation area in order to enable the environmental excavation bucket to remove the targeted material from the designated sediment excavation area.

3.8.2.4. Temporary Sheet Pile Installation

Once the survey was completed, a work boat was utilized to align the barge along the driving line where it was secured with spuds and used as a guide for sheet pile installation to keep the sheeting plum and square during installation activities. Sevenson then began the installation of the temporary sheet pile wall. The rigging on the crawler crane was configured to include a main line that was used to hoist the vibratory hammer and actually drive the sheets and an auxiliary drum line (whip line) that was used to place the king piles and sheet piles into position prior to driving. Dock builders utilized tag lines to control the hammer and hoses during driving operations and ground release spring loaded shackles that enabled them to release the king piles and sheeting from the deck of the barge.

A crane lifted a pair of steel sheet piling to the work barge location. Once the sheet pile was securely placed onto the barge, the ground release shackles were removed and the vibratory hammer was guided into place by support crews and clamped in place. The sheets were then driven to the appropriate grade. Sevenson utilized the crane suspended vibratory hammer to thread the adjoining sheet pile. Once the sheet pile was determined to be plumb and aligned, it was then driven to the desired embedment depth. Sevenson installed (3) paired AZ13 sheet pilings (or equivalent) followed by (1) composite king pile (AZ18 sheets welded to a HP 12 x 74 'H'-pile or equivalent). This routine was followed until the entire temporary sheet pile wall was completed. Once all of the temporary sheet piling was installed, work crews installed the "hanging" waler system across the top of the AZ 18 intermediate sheet piling from the work barge to reduce deflection of the sheets.

3.8.2.5. Additional Spill Control

Sevenson ensured that the vibratory hammers utilized for the construction activities were filled with biodegradable hydraulic oil and that the sheeting / work area was surrounded by oil absorbent booms as well as a turbidity curtain. Sevenson also had a workboat equipped with oil absorbent pads, additional oil boom, disposal bags and USCG required safety equipment in close proximity to the work area in order to contain any spills, sheen or "rose buds" in the event that these situations arose.

The sheeting installation commenced at the western or downstream portion of the excavation area (Mudflat Area) and progressed east or upstream of the area. This sequence allowed the Mudflat excavation work to be completed in conjunction with the temporary sheet piling installation. Severson was able to conduct these operations concurrently because the land based 280 ton crane was able to load the material barge with enough material to keep work crews occupied while the excavation was conducted in the mudflat areas.

The location where the temporary sheet pile wall met the permanent sheet pile wall, had a “gap” that was closed with sand bags, silt fencing, and oil sorbent boom. Since this point was located adjacent to the mudflat excavation area, and was, at times, voided of water during low tides, this “connection” was visible and maintained on a daily basis.

Severson installed and maintained navigation aids and markers on the installed sheeting as recommended by the USCG. This consisted of warning lights, warning signs, and/or marker buoys.

3.8.3. Mobilization of Equipment for Excavation

The 280 ton crawler crane that was utilized for the installation of the temporary sheet pile wall was responsible for the planned removal of 4,500 cubic yards of PCB laden material from the mudflat and deep water areas of the Delaware River bed as estimated in the approved work plans. The equipment that was utilized for the sediment removal and backfill operations consisted of:

- (1) 280 ton crawler crane, equipped with a 4 cubic yard Cable Arm environmental clamshell bucket and a ClamVision global positioning satellite system, capable of X, Y and Z control;
- (1) 2 and (1) 4 cubic yard conventional clamshell or digging bucket for the crawler crane that removed dense material that would normally be problematic for the Cable Arm environmental clam shell bucket;
- (1) 60,000lbs to 80,000lbs class hydraulic excavator that assisted with the transportation of sediment from the skip boxes to the tandem dump trucks;
- (1) 40,000lbs hydraulic excavator that assisted with the unloading of trucks at the sediment drying pad / material handling pad as well as to maintain the dried material stockpile inside the material handling pad;
- (1) rubber tire front-end loader equipped with a 3 to 4 cubic yard bucket that assisted with the maintenance of the construction haul routes and crane pads;
- (1) rubber tire front-end loader equipped with a 2 to 3 cubic yard bucket that assisted with the stockpiling of dry material on the material handling pad;

- Multiple 2 to 4 inch submersible and trash pumps that were placed in the material handling pad to remove decanted water from the saturated soil. This water was pumped to the on-Site water treatment plant. These pumps were also utilized to decant any significant water inside the skid boxes, which was also pumped to the water treatment plant;
- (2) 80,000GVWR tandem axle dump trucks with sealed tail gates; and
- Multiple Skip Boxes with an approximate area of 10'x 15'x 4' and the capacity of approximately 20 cubic yards of storage.

Sevenson directed operators operating the tandem dump trucks to follow a designated hauling route during removal of sediments from the mudflats and deep sediment area. Operators followed the same route from the sediment loading area to the 155' x 155' sediment management pad. The sediment management pad, previously constructed by TtEC as the soil management pad, was used to decant the sediment before proper disposal or placement on the Site beneath the soil cap.

Once the temporary sheet pile was installed, the monitors positioned, and all the necessary protocols stated above were completed, Sevenson commenced the removal of PCB laden sediment in two separate operations that consisted of:

- The excavation of the shallow Mudflat Area (tidally dry) located on the west side of the existing permanent sheeting wall along the shoreline that is exposed at low tide.
- The Deep-Sediment excavation that took place after the temporary sheet pile wall was installed around the excavation area and the completion of the mudflat excavation.

3.8.3.1. Mudflat Excavation

The Sediment Excavation aspect of the work was implemented in accordance with Section 5.4.5 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 18-29. The work requirements were established by Specification(s) 02900 and depicted on Plan(s) S-4, S-5, C-32, C-33, C-34, C-35, C-36, and C-37 and modified by CCRs 18, 34, 36, 53, 58, 59, 100S, and 104S. The general methods and materials were per submissions of work-related Submittal(s) F002, F003, F004, F005, F006, F020, F035, F042, F050, F051, F104S, F107S, and F108S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F111S, F112S, F116S, F119S, and F123S. Upon completion of the Sediment Excavation aspect of work, the "as built" condition is documented in Submittal F129S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are further details on the accomplishment of the work.

Sevenson utilized the land based 280 ton crawler crane to remove impacted sediments from the Mudflat Area. The crane was equipped with a 4 cubic yard Cable Arm environmental clamshell excavation bucket and ClamVision GPS technology. Sevenson downloaded the excavation limits (that were based on 2 to 4 feet excavations beyond the 1999 bathymetric survey) into the ClamVision software to establish control. Once the excavation limits were installed in the unit, Sevenson removed the required amount of sediment from each area. The Cable Arm environmental clamshell bucket provided Sevenson with a safe and precise removal of contaminated sediment. The utilization of the Cable Arm clamshell minimized the re-suspension of contaminants, reduced the risk of over excavation and limited the amount of water removed with each bucket.

The GPS ClamVision software is a fully integrated dredge or excavation positioning system. ClamVision gave Sevenson a real time view of the crane and clamshell bucket positions as they existed. The precision of the Cable Arm Clamshell and the ClamVision GPS provided Sevenson with the proper controls to remove sediment from both the mudflat and deep excavation areas. The GPS ClamVision software utilized real time kinematic (RTK) technology, which allowed the crane operator to see the areas where the sediment was being removed on a monitor mounted inside the cab of the crane. Daily records of the ClamVision outputs are contained in Sevenson's Daily Reports in Appendix C.

The 280 ton crawler crane was positioned at the recommended safe distance for ground pressure of 30 feet from the wall. The excavation pattern began with the outer sediments in the mudflats at the western portion of the jobsite and proceeded inward toward the shore once the entire outside radius was removed. As the crane, equipped with the environmental clamshell bucket, removed the sediment from the mudflats, it cast the material into awaiting skid boxes that were positioned on the upland area which was placed in the direct path of the cranes swing radius. The 280 ton crawler crane removed sediments from between the sheets of the temporary sheet pile wall. Sevenson also utilized a 60,000lb to 80,000lb class excavator to remove sediment from between the sheets of the sheet pile wall, casting the material into waiting dump trucks.

Sevenson used a range of different clamshell buckets, both size and style. The purpose for the use of a 2-4 cubic yard bucket was to be sure that the crane's reach capacity would not limit the use of a clamshell. The environmental clamshell bucket had difficulties removing more dense sediment and debris from the excavation zones; therefore, Sevenson employed a conventional clamshell bucket that had the ability to dig into dense sediment.

In order to prevent spillage and cross contamination of the shoreline and permanent sheet pile wall, Sevenson deployed 6-mil polyethylene sheeting under the swing radius of the crane where the dump trucks and skid boxes were positioned for loading. To prevent the

migration of sediment during the transportation of the material from the sediment loading area to the material handling pad, Severson draped a tarp over the loading side of the dump truck while the loading process took place. A 60,000lb to 80,000lb class excavator was positioned to remove the material placed in the skid box and load the trucks. Once the trucks were loaded, the side tarp was removed and the trucks transported the excavated sediment to the 155' x 155' sediment management pad where it was released. A dump ramp was constructed with dense grade aggregate (DGA) fill at the interface of the southern cap and sediment management pad. When a loaded truck reached the sediment management pad a laborer guided the truck into position and the load was dumped. In order to control the splashing of saturated sediment outside of the sediment management pad, the truck dumped in a slow cautious manner. After the load was dumped, the laborer directed the truck forward to remove any sediment or debris that would impede the proper sealing of the tailgate. Once the tailgate was sealed the truck returned to the sediment loading area via the pre-determined hauling route.

At the sediment management pad, a rubber tire front-end loader equipped with a 2-3 cubic yard bucket was used to handle the incoming sediment material as required for drying and stockpiling. The sediment management pad was further divided into three 500 CY bins for segregation, sampling, and treatment (if necessary). Additional 2 to 4 inch submersible and trash pumps were placed in certain areas around the sediment management pad to remove any water inside the pad in order to allow the sediment to dry. This water was pumped to the on-Site waste water treatment plant.

The excavation proceeded from the riverside of the mudflats toward the shoreline, working from west to east. Once a section of excavation was completed, a survey of the area was performed to verify that the design criteria had been achieved. Verification surveys were performed using conventional and GPS survey equipment in shallow or dry areas. Due to the soft sediment, the surveyor utilized a 6 inch disk attached to the bottom of the survey rod while performing topographic surveys in the excavated mudflat areas. In shallow water areas, Severson provided a work boat to allow the surveyor to gain access to the sediment removal area. The survey process continued to follow the excavation as it proceeded east.

Severson also conducted visual verification in the field to confirm that no visible oil was present. If the initial removal of the sediment to the excavation limits was completed and oil was still visible, Severson removed an additional two feet and performed another verification survey as well as visual inspection. If the second visual inspection once again revealed that oil was still present, Severson removed an additional one foot of sediment. Visually impacted sediments were observed in the transition area between the Mudflat Area and the Deep Water excavation area, along the permanent sheet pile wall.

Additional sediment was over-excavated as described above until visually clean sediment was observed.

After confirmation of the attainment of the remediation surface in the Mudflat Area, Severson then decontaminated the excavator bucket in a previously constructed contamination reduction zone and used this equipment to install the Mirafi 1100 NPA geotextile fabric and clean backfill during low tide. Further explanation of the backfill operation can be found in Section 3.8.3.5 below.

3.8.3.2. Deep Water Excavation

The Sediment Excavation aspect of the work was implemented in accordance with Section 5.4.5 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 18-29. The work requirements were established by Specification(s) 02900 and depicted on Plan(s) S-4, S-5, C-32, C-33, C-34, C-35, C-36, and C-37 and modified by CCRs 18, 34, 36, 53, 58, 59, 100S, and 104S. The general methods and materials were per submissions of work-related Submittals F002, F003, F004, F005, F006, F020, F035, F042, F050, F051, F104S, F107S, and F108S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittals F111S, F112S, F116S, F119S, and F123S. Upon completion of the Sediment Excavation aspect of work, the "as built" condition is documented in Submittal F129S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are further details on the accomplishment of the work.

To perform the deep-water excavation, Severson utilized the same 280 ton crawler crane with an appropriately sized Cable Arm environmental clam bucket positioned a minimum of 30' inside the previously installed permanent sheeting wall in the same manner as the mud flats excavation was conducted. The crane was equipped with a 4 cubic yard Cable Arm environmental clamshell bucket and ClamVision GPS technology. This environmental clamshell bucket and GPS software allowed the crane operator to visually see the movement of the bucket in real time motion on the screen located in the cab of the crane. Severson also utilized a conventional clamshell bucket that had the ability to remove firm sediment that was problematic for the environmental clam bucket. Severson downloaded the excavation limits, (that were based on 2 to 4 feet excavations beyond the 1999 bathymetric survey), into the ClamVision software to establish control. Once the excavation limits were installed in the unit, Severson removed the required amount of sediment from the deep sediment excavation area. The deep water excavation work commenced at the points furthest from shore in the deep water areas using the crane and environmental clam bucket, and worked inland toward the shallow areas. An arc pattern was utilized for the excavation to ensure proper coverage. This also allowed any

sediment that may have spilled out of the bucket to be re-excavated and removed as the excavation operation worked back toward the shore. The 280 ton crawler crane removed sediments from between the sheets of the temporary sheet pile wall. Severson also utilized a 60,000lb to 80,000lb class excavator to remove sediment from between the sheets of the sheet pile wall, casting the material into waiting dump trucks. Upon completion of the excavation, Severson completed the verification survey in accordance with the USEPA approved RAWP and specifications in order to be sure that all the required grades were met and the removal of the material to the excavation limits were achieved.

To control the work and ensure that Severson was achieving proper excavation depths and removing all of the material as required, both a crane mounted GPS and a conventional survey crew was used to ensure that the excavation was in compliance with the design and that no contaminated sediment was left behind.

On shore at the loading operation, Severson deployed a piece of plastic/liner over the swing radius of the clam bucket in order to contain any spillage of the excavated materials while they were being loaded into temporary skip boxes. This material was then transferred from the skip boxes into trucks by 60,000lb to 80,000lb class excavator and transported to the material staging pad in the same fashion that was utilized during the mudflat excavation. Although all of the loading work was taking place within the exclusion zone, in an effort to keep the trucks as clean as possible, Severson draped the sides of the trucks with light tarps to keep the exterior as clean as was practical. In addition, to further control the potential migration of contamination, Severson operated the dump trucks transporting material on haul routes within the exclusion zone that were maintained as appropriate.

At the sediment management pad, a rubber tire front-end loader equipped with a 2-3 cubic yard bucket was used to handle the incoming sediment material as required for drying and stockpiling. The sediment management pad was further divided into three 500 CY bins for segregation, sampling, and treatment (if necessary). Additional 2 to 4 inch submersible and trash pumps were placed in certain areas around the sediment management pad to remove any water inside the pad in order to allow the sediment to dry. This water was pumped to the on-Site waste water treatment plant.

3.8.3.3. Geotextile and Backfill Installation in Sediment Removal Areas

Prior to deployment of geotextile and backfill in the sediment excavation areas, Severson conducted verification surveys to confirm excavation operations were complete. Once all of the verification surveys were complete and it was determined that the sediment excavation objectives had been achieved by removing the material to the excavation limits based on the 1999 Bathymetric survey, Severson initiated the deployment of the

non-woven geotextile fabric and minimum of 1' of R-3 rip rap stone over the excavation areas as required in the Mudflats and Deep Sediment Excavation Areas. Installation of geotextile and backfill in the sediment excavation areas was initiated on September 9, 2009 and verified to be complete on December 3, 2009.

3.8.3.4. Deployment of Geotextile in the Mudflats

The Deployment of Geotextile aspect of the work was implemented in accordance with Section 5.4.5 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 29 and 30. The work requirements were established by Specification(s) 02273 – Geotextiles and 02900 – Sediment Excavation and Sub-Aqueous Cap and depicted on Plan(s) C-32. The general methods and materials were per submissions of work-related Submittals F003 and F004 to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected (visual observation and photologs) during this work is presented in the Malcolm Pirnie and Severson Daily Reports. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

Geotextile was installed in the Mudflat Area during low tide while visibility was not restricted. The geotextile was placed in the excavated area prior to the initiation of backfill installation in the Mudflat Area.

Severson custom fabricated panels of geotextile fabric that were deployed over the Mudflat Area. To fabricate each panel, Severson placed plastic sheeting on the ground and then rolled out the appropriate amount of geotextile fabric parallel to the shore and permanent sheet pile wall. Next, Severson sewed the seams between the panels with a commercial grade hand held sewing machine in an accordion manner on shore. Severson then placed plastic sheeting on the river bank to the north of the sheet pile wall and over the sheet pile wall to prevent tears or snags. The polyethylene was used to reduce the friction of geotextile fabric as it was pulled into position. Once Severson completed the use of the polyethylene it was removed and placed with the oil saturated boom in a lugger box (roll-off) where it was stored for characterization and disposal.

Severson then positioned the geotextile fabric on the river bank and manually pulled the fabric into the Mudflat Area at low tide. Geotextile along the Mudflat Area and the sheet pile wall were secured to the wall before it was manually lowered into the Mudflat Area at low tide.

Once the material was in position, Severson had a 2-man crew secure the geotextile fabric to the enhanced super silt fence. Polypropylene rope was utilized to secure the textile to the fence. The rope also served as a visual marker to ensure the geotextile had been placed in the proper location. Before deploying the geotextile, Severson sewed

additional fabric to ensure that there would be enough overlap along the sheet pile wall while backfill was placed.

3.8.3.5. Installation of Approved backfill

Sevenson utilized a front end loader to build an access ramp for an excavator to access the Mudflat Area. During low tide, the excavator placed a minimum of 12 inches of approved R-3 stone into the mudflats, starting closest to the ramp and working out, toward the Mudflat Area. The ropes used to deploy the fabric were left in place to keep tension on the fabric and to prevent bellowing while the balance of the stone was being deployed. While using the front end loader to supply stone to the excavator in the Mudflat Area, the stone was placed in a controlled manner to minimize the potential for turbidity and disturbance to the previously placed non-woven fabric. A bulldozer was also utilized to spread the stone backfill in the Mudflat Area.

Along the transition between the Mudflat and the Deep Sediment Excavation Areas where the temporary sheet pile wall was installed, Sevenson draped additional fabric up the sheets. This was done so that when the sheets were removed, the fabric would fall into place and obtain the correct overlap. The method eventually proved to be unsuccessful so, Sevenson later deployed an additional piece of fabric over this location before placing the stone backfill.

3.8.3.6. Deployment of Geotextile and Stone in Deep Sediment Excavation Areas

The Deployment of Geotextile aspect of the work was implemented in accordance with Section 5.4.5 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 29 and 30. The work requirements were established by Specification(s) 02273 – Geotextiles and 02900 – Sediment Excavation and Sub-Aqueous Cap and depicted on Plan(s) C-32. The general methods and materials were per submissions of work-related Submittal(s) F003 and F004 to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected (visual observation and photologs) during this work is presented in the Malcolm Pirnie and Sevenson Daily Reports. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

The deployment of the geotextile fabric and stone in the Deep Sediment Excavation Areas, Sheet Pile Zones 2 and 3, was done through the water column. A different approach than that utilized in the Mudflat Area was employed for the work in this area. Since the temporary sheet pile wall was in place during the installation of the geotextile fabric and backfill in this area, the Delaware River current and associated tidal fluctuation did not have a significant impact on the placement of these materials.

3.8.3.7. Deployment of Fabric

To minimize issues with the overlap on the geotextile fabric in this area, Severson divided the deep water excavation area into three sections. Once the sections were properly delineated, Severson custom fabricated (by sewing with polymeric thread) a single sheet of geotextile fabric that was deployed over each section. Prior to fabricating the sheets, Severson placed polyethylene sheeting on the ground to create a clean work area. To fabricate each sheet, Severson rolled out the appropriate amount of geotextile fabric parallel to the permanent sheet pile wall and sewed the seams between the panels with a commercial grade hand held sewing machine. Severson sewed the fabric in an accordion manner on shore using an industrial, hand-held sewing machine. Once sewed, Severson secured the fabric to ropes threaded through pulleys attached to the temporary sheet pile wall located on the opposite side of the sediment excavation area where the deployment was occurring. These ropes were then fastened to various land based equipment located on the upland side of the excavation that simultaneously traversed and ultimately pulled the fabric off of the bank and into position. In order to assure a smooth transition off of the bank, Severson deployed polyethylene sheeting underneath the sewn fabric and over the sheet pile wall to prevent any tears or snags. The polyethylene sheeting was used to reduce the friction of geotextile fabric as it was pulled into position. It remained stationary on the shore line and was not deployed into the river with the geotextile. Once Severson completed the use of the polyethylene it was removed and placed with the oil saturated boom in a lugger box (roll-off) where it was stored for characterization and disposal. Severson utilized one signal man or call man to assure that all of the equipment was synchronized. As the fabric was pulled into position, the length of the rope was increased as the machines traversed away from the river. When there was inadequate room for the machine to maneuver, Severson stopped the operation and readjusted the ropes to each machine in order to remove slack in the line.

Once the material was in position, Severson had a 2-man crew, in a work boat, secure sand bags on one side of the fabric to sink it into position. Polypropylene rope and buoys were also secured to the edge of the first piece and used as a visual marker to ensure the material had been placed in the proper location.

3.8.3.8. Installation of Approved Stone Backfill

Once it was verified that the first panel of the geotextile was in place, the land based 280 ton crawler crane with a 4 cubic yard material handling bucket was utilized to place the required R-3 approved stone backfill along the shoreline edge to secure the fabric so the other end of the fabric could be stretched out and deployed. The ropes used to deploy the fabric were left in place to keep tension on the fabric and to prevent bellowing while the balance of the stone was being deployed. Severson started deploying stone in the shallow area along the shore working out toward the deeper end of the excavation area near the sheet pile wall. While using the clam shell bucket for backfill, the stone was placed in a

controlled manner to minimize the potential for turbidity and disturbance to the previously placed non-woven fabric even though the work was being performed within the sheet pile zone and segregated from the Delaware River.

Stone backfill installation was stopped approximately 5 to 10 feet from the edge of the first panel to leave room for the necessary overlap of material from the second fabric panel. Once the second geotextile panel was fabricated and deployed utilizing the same rope and pulley procedure, the clam bucket was used to place stone on top of the overlap and then continued to place material on the second geotextile panel to within 5 to 10 feet from the end to allow for the third and final geotextile panel to be installed using the same equipment pulley procedures.

Sevenson also installed R-5 scour protection stone (on top of the backfill) approximately 10 feet in front of and to the eastern return of the Permanent Sheet Pile Wall as per the Design Drawings C-26.

3.8.3.9. Verification

Once all of the geotextile and backfill/capping material were deployed, a survey was performed to ensure that the stone had been placed to the proper elevation. A leveling device (a steel beam) was dragged across the top of the stone to smooth it out as required for final verification. A survey was also performed by Rettew to confirm and document that the design limits were achieved.

3.8.4. Turbidity Controls Removed

At the completion of sediment excavation and backfilling activities, Sevenson removed local turbidity controls directly associated with these activities. However, turbidity monitors and turbidity curtains remained in place for the duration of sub-aqueous cap installation activities.

3.8.4.1. Temporary Sheet Pile Removal

After the deep excavation and backfill operations were complete, Sevenson removed the temporary sheet pile wall. The same equipment used to install the sheeting was used to remove the sheeting. Before a sheet pile was removed, a cable was attached to the bottom of the vibratory hammer and threaded through the handling holes of the sheet. The hammer was clamped to the sheet and the extraction process commenced. As a pair of sheets was extracted, measures were taken to prevent the re-suspension of sediments. This included controlling the speed and amount of time that the vibrator on the hammer ran. Sevenson strategically located the material barge to minimize the distance the sheets had to be moved during the removal process. This prevented contamination of any areas that had been properly remediated. After a pair of sheets was pulled and removed from the adjoining interlock, the sheets were moved into place over the barge or back on shore.

The end of the sheet was then rested on the barge or ground and the jaws of the hammer were released and the hammer lifted free of the sheet. At this point the sheet was supported by the previously attached cable and lowered to the deck of the barge or ground. This continued until all of the temporary sheet piles were removed. During the Sheet pile removal activities, Severson continued to closely monitor the work area for any spills, sheen and/or "rose buds" with support crews until all of the sheet piles were removed from the Delaware River.

3.8.4.2. Decontamination

As the sheets were being removed and positioned onto the barge, Severson placed impermeable plastic sheeting on the barge and shore. The sheets were transported from the temporary staging area on shore to the sediment management pad for final decontamination. The decontamination of the sheeting was conducted in a way to prevent any migration of potentially contaminated material off-Site. Additional plastic was deployed over any areas where potentially contaminated material was suspended over previously remediated areas during the transportation of the sheets to the decontamination pad. Sheets were power washed on the sediment management pad. Once clean, they were transferred to the Courtyard Area where they were staged until removed from the Site.

3.9. Subaqueous Cap

The Subaqueous Cap aspect of the work was implemented in accordance with Section 5.4.6 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 33 through 43. The work requirements were established by Specification 02900 – Sediment Excavation and Subaqueous Cap and depicted on Plan(s) C-32, C-33, C-34, and C-36 and modified by CCRs 17, 79, 106S, and 121S. The general methods and materials were per submissions of work-related Submittal(s) F003, F004, F015, F020, F035, F036, F038, F041, F048, F053, F055, F078, F084, F090, F105S, F107S, F108S, F110S, F117S, and F126S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F097S. Upon completion of the Subaqueous Cap aspect of work, the "as built" condition is documented in Submittal(s) F130S, F131S, F134S, F137S, F138S, and F139S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The Subaqueous Cap aspect of the work was initiated by TtEC in the Central Cap Area on November 24, 2008 and postponed during the winter shutdown. Severson initiated the installation of the Subaqueous Cap in the Eastern Area on September 9, 2009 and then proceeded to the Western Cap Area, initiating installation on September 25, 2009. Severson then initiated installation of the Subaqueous Cap in the Central Area on October 14, 2009. The installation of the Subaqueous Cap in all three

areas was verified to be complete on January 7, 2010. Presented below are the further details on the accomplishment of the work.

Subaqueous cap materials (a.k.a. marine mattresses) were placed over the areas specified in the Design Drawings (C-32 to C-36) in areas that were not feasible to perform sediment excavation using land-based equipment. Three distinct subaqueous cap locations were identified on the Design Drawings (Drawing No. S-4). For the purpose of this report they are referred to as the; Eastern, Western and Central Cap areas. TtEC's Subcontractor, Midlantic, placed most of the Central subaqueous cap. The Central subaqueous cap was completed by Severson, as was the Eastern and Western portions of the subaqueous cap. Turbidity monitoring was conducted during placement of capping material to monitor for re-suspension of sediments into the river. Installation work was performed in a manner that prevented re-suspension of sediments in the Delaware River and within a turbidity control zone including a turbidity curtain and oil boom.

3.9.1. Turbidity Control

TtEC deployed 4 (3 originally then added 4th per CCR 59) YSI turbidity meters in the Delaware River during subaqueous cap installation activities. Two work zone monitors were set approximately 100 feet from the work zone (outside the turbidity curtain). Monitors were placed three feet from the bottom of the river to avoid insignificant, naturally occurring turbidity while maintaining the ability to monitor potential construction related turbidity. Monitors recorded data every three minutes. Each reading was the average of the previous three minutes. Initially, the monitors were secured to an industry standard buoy.

However, during Phase 2 of the construction activities the monitors were secured to buoys constructed by Severson specifically for turbidity monitoring. The top side of the instrument mast attached to the buoy housed the data logger, solar panel, antenna and navigational beacon. In addition, a radio frequency telemetry base station unit was installed on the buoy to allow for remote, real-time data collection from the start of turbidity monitoring during pre-subaqueous cap placement to the conclusion of all capping activities. Prior to river work commencing, TtEC monitored background turbidity concentrations for seven days with a background monitoring located 1 mile upstream (adjacent to Pennypack Creek Park) on the Pennsylvania side of the Delaware River. This monitor was far enough upstream not to be influenced by any Site operations. These data were used to compare the on-Site turbidity results to the off-Site results during remediation activities.

Severson continued Turbidity Monitoring and controls as discussed in Section 3.8.2.1 Turbidity Monitoring. Severson installed four turbidity monitors in the locations selected by the USEPA. Prior to initiating the sediment excavation and sub-aqueous cap

installation activities. Severson conducted a new pre-excavation background turbidity monitoring study utilizing the four turbidity monitoring locations selected by USEPA.

3.9.2. Survey

Prior to any subaqueous capping activities, both TtEC and Severson conducted bathymetric surveys to confirm riverbed conditions. Both contractors used Rettew Associates to complete the surveys.

Rettew established a benchmark on land and TtEC set the corners of the Central Subaqueous Cap. Then side-scan sonar was utilized to guide the placement of the marine mattresses and as a quality control measure to verify the orientation of the mattresses. Divers were utilized to verify spacing between individual mattresses and to guide the placement of the mattresses when side-scan sonar could not be utilized (i.e. low tide). Severson utilized Rettew to set the corners of the Eastern and Western subaqueous and to verify the location of the previously installed marine mattresses in the Central Subaqueous Cap locations prior to the initiation of the sub-aqueous cap construction in the Delaware River.

Rettew, with the assistance of the divers, staked the outer perimeter of the proposed sub-aqueous cap locations in 50-foot intervals using plastic pipes and buoys and at each turn for Severson. Once the areas were delineated, Severson surveyed the bottom to determine if any boulders or obstructions were within the proposed sub-aqueous cap areas. No significant obstructions were encountered during the installation of the mattresses. As a means of quality control, the results of the survey were provided to the Engineer for review prior to the start of placement operations.

3.9.3. Sub-Aqueous Capping Mattress System Materials

The Sub-Aqueous Capping Mattress System Materials aspect of the work was implemented in accordance with Section 5.4.6 of the April 4, 2008 approved RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 34 through 38. The work requirements were established by Specification 02900 – Sediment Excavation and Sub-Aqueous Cap and depicted on Plan C-36. The general methods and materials were per submissions of work-related Submittal(s) F003, F004, F015, F020, F036, F041, F055, F105S, F107S, F108S, F117S, and F126S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F097S. Upon completion of the Subaqueous Cap aspect of work, the "as built" condition is documented in Submittal(s) F130S, F131S, F134S, F137S, F138S, and F139S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

TtEC and Severson installed the Triton Marine Mattress System manufactured by Tensar Corporation for the sub-aqueous cap material. The marine mattresses were rock filled containers constructed of high strength geogrid material. Geogrid panels were laced together to form mattress-shaped baskets that were filled with stone similar to the construction of gabion baskets. The mattress also contained non-woven filter fabric.

The typical width for a single marine mattress was approximately 5 feet, but the length varied according to the placement plan. TtEC and Severson placed the rock-filled Triton Marine Mattress System with an average thickness of 1 foot within the proposed sub-aqueous cap areas. The mattress lengths varied depending upon the placement methods. The longest mattress was approximately 35 feet long and weighed approximately 8 tons. During the winter shutdown period, marine mattresses were stored on-Site, under covers. During the initiation of the Phase 2 construction activities, Malcolm Pirnie, Severson, and Tensar inspected the marine mattresses to identify mattresses that were damaged during the winter shutdown. Tensar provided a report that included recommendations for repairs and identification of mattresses to be discarded.

As per the manufacturer, the high-strength geogrid had sufficient strength to permit rock-filled mattresses up to 35 feet in length to be hoisted from one end for placement. TtEC placed marine mattresses by lifting them from only one end. Divers guided the mattresses into place. Once the mattress was in place, the diver released the spreader bar from the end of the mattress and the process was repeated.

Severson utilized a spreader bar and bridle system fabricated on-Site that lifted the mattresses from both ends and had three different length spreader bars capable of lifting one, two or three mattresses at a time. Similar to TtEC, Severson utilized divers to guide the mattresses into place. Once the mattresses were in place, divers removed a quick-release pin and the lifting apparatus was separated from the mattress and returned to the barge to repeat the installation process.

The material used in fabricating the marine mattresses consisted of geogrid, mechanical connectors, braided lacing, and stone. TtEC constructed the mattresses off-Site at the quarry supplying the stone fill, Eureka Stone Quarry in Warrington, PA. Severson constructed the mattresses off-Site at ABC Construction in Bensalem, PA. Empty marine mattresses were delivered in a partially prefabricated state by Tensar to the respective locations. After filling the mattresses with stone and tying them closed with the braided lacing, the fabricator loaded the mattresses onto a flatbed truck for transport to the Site.

A sample mattress was constructed to the satisfaction of the manufacturer and set aside for reference throughout the project. The mattress was weighed on a truck scale to determine the correct weight range and was used as the bench mark for all the other mats. The remaining mats were periodically weighed to ensure uniformity.

3.9.3.1. Structural Geogrid

The geogrid was made of high-density polyethylene (HDPE) and polypropylene and was manufactured so there was complete continuity of all properties throughout the structure. The geogrid material was stabilized against ultraviolet radiation deterioration by the manufacturer. Two types of geogrid were used in the construction of a mattress containment structure. The stronger Type 2 uniaxial geogrid had a breaking tensile strength of 6,908 lb/ft, and was used for the exterior sides of the mattress and the lifting loops. The Type 1 biaxial geogrid had a breaking tensile strength of 3,330 lb/ft and it was used for the interior compartment dividers.

The Triton Marine Mattress System used on this project included a Mirafi 1100N geotextile fabric and an HDPE-composite geogrid attached to the bottom of each mattress. The geogrid and Mirafi 1100N material extended 2-feet beyond the sidewall of the mattress to ensure that a minimum of 1-foot overlap beneath adjacent mattresses was provided.

3.9.3.2. Mechanical Connectors and Braided Lacing

Mechanical connectors used in mattress construction were made of high-density polyethylene and were installed per the details found on Drawing C-36. These connectors resembled long rods having a nominal diameter of 3/8 inch. Metal connectors were not used on this project. Braided lacing, used for tying and lacing the geogrid panels into a mattress with interior compartments, was fabricated of HDPE eight-strand braid having a nominal diameter not less than 3/16-inch and a breaking strength not less than 400 lb. Braided lacing resembled typical plastic rope, but with ultraviolet stabilization.

3.9.3.3. Stone Fill

Stone used to fill the mattress compartments was durable, free of cracks and other defects, and had a specific gravity of at least 2.5. The required average stone diameter for a 12-inch thick mattress was 3-inches (maximum was 6 inches). The rock came from a Pennsylvania Department of Transportation (PENNDOT) approved Type A aggregate in accordance with Construction Specification 02900. The source of the rock was provided to the Engineer, who had the opportunity to inspect and approve the source. The stone was purchased from a commercial quarry and was certified to comply with PENNDOT specifications. TtEC and Severson both used stone material from Eureka Quarry located in Warrington Township, PA. The rock met the requirements of PENNDOT Standard Specifications Publication 408/2007, Section 850-Rock Lining, Size R-3. (Submittals F020, F107S and F108S.)

3.9.4. Preparation for Sub-Aqueous Cap Installation

The marine mattress installation required some Site preparation prior to deploying the mattress units. This work included performing utility location; installation of a

docking/loading area east of the permanent sheet pile wall; the placement of turbidity monitors as required; and the installation of silt curtain/oil boom around the work area. The marine mattresses were transported to the Metal Bank Site where they were off-loaded and either stored on-Site or loaded directly onto barges. The number of mattresses loaded onto the barges varied and was dependent upon several factors, including; depth of water (tidal influence), capacity of the barge, and production rates of the installation crew.

3.9.4.1. TtEC Preparation for Sub-Aqueous Cap Installation

TtEC offloaded the marine mattresses near the shoreline in the Southern Area of the Site along the bank of the Delaware River where they were easily loaded onto the work barge for placement in the river. Mattresses were placed on the working barge with similarly sized mattresses stacked together using a land based crane. Once the working barge was loaded with enough mattresses for the day, the barge was moved adjacent to the barge mounted crane where the operator could then begin deploying the mattresses.

Mattresses were lifted from one end depending on the location where the mattress was placed. Units were lifted from the horizontal position in a manner that minimized severe bending or distortion of the top and bottom geogrids.

3.9.4.2. Severson Preparation for Sub-Aqueous Cap Installation

Severson also constructed a temporary docking/loading area to allow for safe ingress and egress of both manpower and equipment between the shore and the work vessels. A floating dock was installed to the east of the permanent sheet pile wall. The shoreline was also improved to facilitate use of the docking area, as well as for allowing for safe and efficient use by all parties of concern. Shoreline improvements consisted of crushed stone for bank stabilization and are not believed to have impacted river sediments.

3.9.5. Subaqueous Cap Layout

TtEC's Subcontractor, Midlantic, installed the Central sub-aqueous cap in locations marked on C-34 (Sediment Excavation Sections) and described in Construction Specification 02900 – Sediment Excavation and Sub-Aqueous Cap. The cap was placed in the Central sub-aqueous cap area via barge-based crane.

Severson installed the sub-aqueous cap in locations marked on Design Drawings C-32 (Sediment Excavation Plan - South and Mudflat Areas), C-33 (Sediment Excavation Plan North Area) and C-34 (Sediment Excavation Sections), C-36 (Sediment Excavation & Sub-Aqueous Cap Details), and as described in Construction Specification 02900 - Sediment Excavation and Sub-Aqueous Cap. The sub-aqueous cap was installed south of the Mudflats and Delaware River area beyond the southeastern corner of the Site. [Note: The Central sub-aqueous cap area was completed by Severson to meet the contract

specifications.] The Sub-aqueous cap was deployed with a crawler crane mounted on a deck barge.

3.9.6. Placement of Mattress Capping System

3.9.6.1. Central Capping Area

The Subaqueous Cap aspect of the work was implemented in accordance with Section 5.4.6 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 33 through 43. The work requirements were established by Specification 02900 and depicted on Plan(s) C-32, C-33, C-34, and C-36 and modified by CCRs 17, 79, 106S, and 121S. The general methods and materials were per submissions of work-related Submittal(s) F003, F004, F015, F020, F035, F036, F038, F041, F048, F053, F055, F078, F084, F090, F105S, F107S, F108S, F110S, F117S, and F126S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F097S. Upon completion of the Subaqueous Cap aspect of work, the "as built" condition is documented in Submittal(s) F130S, F131S, F134S, F137S, F138S, and F139S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

TtEC loaded the work barges, one at a time, with marine mattresses. The barges were towed into place, adjacent to the crane barge that was already anchored in position with spuds. TtEC maneuvered marine mattresses into position from the work barge using the crane and tag lines. Personnel on the barge and in the water were instructed to stay clear of the area beneath the mattresses and support riggings at all times during a lift.

A marine surveyor, Alpine Ocean Seismic Survey, Inc., installed a GPS system on the crane barge so accurate locations of the barge were known at all times. The barge had reference points, provided by Rettew, on it so conventional land survey equipment could be used to perform quality control. Alpine Ocean Seismic Survey, Inc. provided a Side Scan Sonar technology which was used to assist Midlantic's crew by providing high resolution geo-referenced images shortly after the mattresses were placed. The Side Sonar system, Kongsberg Mesotech MS 1000 High Resolution Scanning Sonar provided a comprehensive overview of mattress layout close to real time. The design layout (in AutoCadd format) for the central area was imported into the sonar system, which had the ability to perform real time underwater viewing. This layout had coordinates for each mattress scheduled to be placed. Targets for each subsequent mattress were installed on the computer screen for the foreman to view as each mattress was being placed. Adjustments were made in the field for actual slope conditions as necessary to ensure complete coverage. After the initial placement, mattresses were lifted and repositioned as final adjustments were made with the aid of divers. Since the mattresses had pre-attached

geotextile filter fabric, care was taken to assure proper overlap of the fabric as the mattress was placed. Side-scan sonar information was provided by TtEC in its Daily Reports, included in Appendix C. The empty barge was loaded while marine mattresses were being placed. Work commenced inshore and proceeded in an outward direction, heading upstream. This ensured the spuds on the crane barge did not go through the previously placed mats and proper overlapping of geotextile. The crane barge was periodically moved with a boat or adjusting spuds as necessary to position itself for the next series of mats within the safe working limits of the crane. This process continued until ice flow in the Delaware River created unsafe working conditions in January 2009 and the Site entered a winter shutdown.

Prior to winter shutdown, it was observed that the first three marine mattresses in the northwestern corner of the Central Cap Area were aligned differently than the rest of the mattresses in the first row of this Area. The misalignment of the mattresses in this area caused the spacing between the mattresses to be greater than the design tolerance of 4 inches. To correct this, SES placed an additional mattress over the gap between the mattresses exceeding 4 inches as described in Section 3.9.7 of this Report.

During the mobilization for Phase 2 of the construction activities, Severson surveyed the Central Cap Area and determined that the entire first row had been misaligned, causing the mattresses to cover a slightly larger area than that depicted on Drawing C-33 and that additional mattresses were required to complete the southern portion of the subaqueous cap in the Central Cap Area – see CCR 106S for the additional 9,800 square feet of marine mattresses that were installed in the Central Cap Area.

3.9.6.2. Subaqueous Capping (Eastern, Western & Remaining Central)

The Subaqueous Cap aspect of the work was implemented in accordance with Section 5.4.6 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 33 through 43. The work requirements were established by Specification 02900 and depicted on Plan(s) C-32, C-33, C-34, and C-36 and modified by CCRs 17, 79, 106S, and 121S. The general methods and materials were per submissions of work-related Submittal(s) F003, F004, F015, F020, F035, F036, F038, F041, F048, F053, F055, F078, F084, F090, F105S, F107S, F108S, F110S, F117S, and F126S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F097S. Upon completion of the Subaqueous Cap aspect of work, the "as built" condition is documented in Submittal(s) F130S, F131S, F134S, F137S, F138S, and F139S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

Prior to Severson's arrival to the Site, TtEC previously constructed and deployed marine mattresses in the Central Subaqueous Cap Area. Some of these mattresses were stored on-Site during the winter shutdown. During mobilization for Phase 2, these mattresses were inspected by a Tensar representative, Severson's quality control manager, and the resident engineer from Malcolm Pirnie. Most of these mattresses were deemed acceptable for deployment and thus were deployed. Those that were not deemed acceptable for deployment were set aside and not used in the sub-aqueous cap. Tensar prepared a report of its findings which is included in Appendix H.

Once Site preparation was completed, Severson began placing the Triton Marine Mattress System. Mattress units were placed in position at the proper elevations and in proper alignment and pattern as per the layout plan prepared by Tensar. Severson varied the lengths of the mattresses to simplify the installation and management of the mattresses.

Severson completed the installation of marine mattresses in the Central Cap Area and made repairs to all three subaqueous cap locations as described below in Section 3.9.7 Repairs.

Mattresses were placed on the material barge with similar sizes stacked together. Once the material barge was loaded with enough mattresses for the day, this barge was moved adjacent to the barge-mounted crane where the operator could then begin deploying the mattresses.

To expedite production and provide better quality control in regard to the spacing between the mattresses, Severson laced up to 3 of these mattresses together for placement at one time, when feasible.

Mattress units up to 35-feet in length were lifted from both ends using a bridal /spreader bar assembly. Units were lifted from the horizontal position in a manner that minimized severe bending or distortion of the top and bottom geogrids. Severson's goal was to maintain a fairly uniform tensioning of the geogrid across the width of the mattress. As noted earlier, Severson fabricated a lifting bracket that enabled one, two, or three mattresses to be installed simultaneously with each cycle of the crane.

Units were maneuvered into position using tag lines as personnel were instructed to stay clear of the area beneath the units and support riggings at all time during a lift. After the initial deployment, a diver was utilized as necessary to aid in the final positioning and placement of the units to ensure the maximum 4-inch spacing between the mattresses was not exceeded. It was not necessary to connect adjacent mattresses once in place. Since the mattresses had pre-attached geotextile filter fabric, care was taken to assure proper overlap of the fabric as the mattress was placed.

3.9.7. Repairs

The marine mattresses were placed in a continuous manner (approximately 2 to 4 inches apart). In the event that spacing in any location was greater than 4 inches, stone wrapped in geotextile fabric was placed between the marine mattresses in order to fill in the gaps. To make the repair, divers were used to secure fabric over the area in question. Five (5) gallon buckets full of stone were lowered to the divers to fill the void with stone. Once full, the excess fabric was folded back over the top of the newly placed stone to complete the repair. On November 16, 2009, a repair of a 40" long x 4" wide gap was completed using a specially constructed mattress sized to fill the gap. This repair is documented in the construction progress photographs. Subsequent repairs were conducted in accordance with the EPAs approved work plan as agreed upon in an e-mail correspondence dated November 19, 2009. Construction progress photos show that the repairs were completed on December 1, 2009. On December 4, 2009, the EPA was present for an inspection of the correction and provided verbal acceptance; this inspection is documented on the independent quality control report prepared by Applied Environmental Management, Inc.

Placement of the mattresses and completion of the repairs was confirmed by a diving subcontractor. The Dive Foreman's Certifications are included as Appendix Q.

3.9.8. Buttress Stone

After successfully completing the installation of the Triton Marine Mattresses in the Subaqueous Cap Areas (Eastern, Central and Western), Severson initiated the installation of the Subaqueous Cap Buttress as specified in section 02900 and detailed on Design Drawings S-4 and S-5. The Subaqueous Cap Buttress material consisted of a 2' high by 8' wide barrier along the specified perimeter of the subaqueous mattresses previously placed in the Eastern, Central and Western Areas of the subaqueous cap to act as a barrier to prevent the migration of the placed mattresses. The location of this buttress is indicated on the As-Built drawings in Appendix E.

Due to tidal conditions of the Delaware River and the Subaqueous Cap work zone, Severson needed to devise a system to assure proper placement of the stone in a zero visibility working environment. The most effective system to assure accurate placement of the stone was through the utilization of PVC poles and buoys placed at approximately fifteen foot increments along the perimeter of the previously placed subaqueous mattresses. This provided a visual aide to the designated spotter and crane operator in order to assure proper placement. The stone was placed using a 150-ton crawler crane equipped with a 4 cubic yard conventional clamshell bucket mobilized on the spud barge. The spud barge was moved using a diesel powered push boat to the desired location. Using the indicator buoys or PVC poles, the designated spotter on the barge directed the crane operator as to where the bucket of stone was required based on the previously placed bucket. Since the specified width of the buttress area was to be a minimum of

eight feet, Severson placed two to three buckets abreast before proceeding to the next location along the perimeter of the subaqueous mattresses. The amount of buckets placed (2 or 3) was based on the amount of stone placed by the previous bucket. Severson placed additional buckets of stone prior to proceeding along the perimeter of the subaqueous mattresses to assure the proper amount of coverage had been achieved. As Severson installed the stone, the linear footage and volume of stone was recorded for each day of production. This allowed Severson to accurately track the amount of material being placed. Based on the contract documents, Severson was required to place approximately 1,200 (+/-) tons of R-6 stone around the perimeter of the mattresses. In order to ensure that Severson achieved the intent of the design, Severson placed 1,646 tons of R-6 stone. Based on the system design prepared by AMEC in the USEPA-approved "Final Design Report, this amount of material provides adequate tonnage that will prevent the migration of the placed mattresses.

3.9.9. Verification

Upon completion of Subaqueous Capping and Buttress Stone placement activities, Severson utilized the surveying service of Rettew as well as Dryden Diving Co. Inc., to verify the placement of the mattresses and stone. The divers inspected the area where the mattresses and stone had been placed to assure no significant gaps were left between mattresses and the buttress and to confirm that the stone was placed in the proper position. Once the area had been verified, Rettew was utilized to obtain verification data to generate as-built drawings. The divers assisted the surveyors during the surveying activities by placing buoys along the buttress alignments.

3.10. LNAPL Monitoring Trench Installation

The LNAPL Monitoring Trench Installation aspect of the work was implemented in accordance with Section 5.4.9 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Pages 45 through 48. The work requirements were established by Specification 02220 – LNAPL Monitoring Trench and depicted on Plan(s) C-4, C-7, and C-23 and revised Plans C-1 through C-6 prepared by AMEC dated September 25, 2009 and modified by CCRs 89S, 92S, 98S, 109S, 113S, 118S, 119S. The general methods and materials were per submissions of work-related Submittals F114S, F114-A S, F115S, 118S to assure that the technical specification and plan details met the design criteria/requirements. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal F136S. Upon completion of the LNAPL Monitoring Trench Installation aspect of work, the "as built" condition is documented in Submittal F146S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The LNAPL Monitoring Trench aspect of the work was initiated on October 15, 2009 and

was substantially complete by December 8, 2009. Presented below are the further details on the accomplishment of the work.

At the conclusion of the SA-4/5 excavation activities, TtEC removed oily product from the surface of the water at the bottom of the excavated area and allowed the area to stabilize for 72 hours in accordance with Specification 02220. Following this, the area was inspected by TtEC, Malcolm Pirnie, and the USEPA and even though no product greater than 1/16 of an inch thick was observed to be flowing into the excavation, the Cottman Avenue PRP Group elected to install the LNAPL Monitoring Trench (see Figure 4).

In preparation for excavation of the LNAPL Trench, Severson excavated 8 test-pits along the LNAPL Trench alignment to pre-characterize the soil for disposal purposes. Based on the results of the test-pitting activities, USEPA required that additional soil, outside of the Trench alignment, with potential PCB concentrations in excess of 25 ppm be removed for off-Site disposal. On November 20, 2009, Severson completed the excavation and removal of approximately 325 cubic yards of soil from the northern side of the LNAPL Trench. The excavation area was located to the north of the LNAPL Trench, between LNAPL Sumps 4 and 5 (in the vicinity of Test-Pit #2) and covered an area approximately 23 feet by 60 feet and extended approximately 12 feet deep. Following the soil excavation and removal activities, USEPA also required that soil borings be installed in several locations surrounding the LNAPL Trench alignment. In early December 2009, Severson installed nine soil borings in the vicinity of the LNAPL trench. Soil samples were collected and submitted for Total PCB Aroclor analysis consistent with the approved plans for the soil boring program (USEPA on December 3, 2009). Of the nine soil samples collected, only one sample exceeded the soil cleanup standard established for the Site (25 ppm Total PCBs). Soil samples MB-CS-Boring 10 exhibited a total PCB concentration of 104 ppm. This boring was located on the eastern side of the Site between the LNAPL trench and deadmen. As previously discussed at a meeting with USEPA in November 2009, it was Malcolm Pirnie's opinion that removing soils between the LNAPL and deadmen was not technically feasible because the removal of this material would adversely affect the structural integrity of the deadmen and LNAPL trench as well as the potential volume of soil affected would not be of a significant quantity. In addition to all of these activities, the Utility Group also elected to extend the length of the LNAPL Trench by approximately 50 feet at each end of the Trench to allay USEPA concerns regarding potential migration of subsurface oils potentially containing PCBs.

3.10.1. Installation of the LNAPL Collection Trench

Prior to initiating the installation of the LNAPL Trench, the design engineer, AMEC, prepared revised drawings to accommodate a field change of the location of the LNAPL Trench. Severson had its subcontracted surveyor, Rettew Associates, mark-out the trench alignment between the SA4/5 remediation area and the sheet pile wall deadmen support

structures per the revised AMEC design. Severson then utilized a hydraulic excavator to begin the removal of material. Severson utilized trench boxes since the trench was constructed through unstable, non-homogenous debris to depths of up to 15 feet below existing ground. Severson removed the overburden within the trench box down to the ground water level across the entire interior of the box. Once the overburden above the ground water table was removed, Severson continued to excavate the additional 2 feet of material from below the ground water table to achieve the final design elevation of the bottom of the trench. Severson anticipated a significant amount of water to be encountered toward the bottom of the trench excavation due to the proximity of the river and type of material that they were excavating through. In order to avoid the need to manage and treat this water, Severson performed this work “in the wet” and installed the 4-foot thick drainage stone layer through the 2 feet of standing water that was encountered at the bottom of the trench.

When Severson encountered LNAPL product in the trench during installation, Severson took an active approach to contain and absorb the material during the trench construction. The product was captured using oil absorbent boom and absorbent pads. Once the absorbent pads and boom were saturated with product, Severson properly disposed of the material in a lugger box that was staged on-Site for this specific purpose.

Once the design elevation was achieved and verified via survey, laborers used ropes and poles, as needed, to place and deploy the geotextile across the bottom of trench and up the sides of the trench walls. Once the fabric was in place, the backhoe placed stone on to the fabric in order to weigh it down under the 2 feet of water. Once the fabric was submerged, the excavator continued to build the stone up to the final 4-foot thickness as shown on the Contract Drawings. When the stone was installed to the required elevation and verified via survey, the geotextile was folded over the top of the stone in a “burrito” like fashion.

Once the fabric was in place, the overburden that was removed, sampled and approved for use as backfill from the initial trench excavation was placed back in the trench in lifts and compacted with the back side of the excavator bucket.

3.10.2. Sampling of the Removed Trench Spoils

Prior to excavating the LNAPL Trench, Severson collected soil samples from test-pits excavated along the LNAPL Trench alignment to pre-characterize the material to be excavated. The results of the pre-characterization samples revealed the presence of PCBs in excess of 25 ppm and USEPA required additional excavation to remove those soils. Therefore, the LNAPL Trench was extended an additional 50 feet at each end and approximately 325 cubic yards of soil were removed from a location adjacent to the LNAPL Trench in the vicinity of test-pit 2. Following the removal of the soil from the

new excavation area, the sidewalls were sampled and found to be below 25 ppm. The excavation was then backfilled with imported, clean material.

During the installation of the trench, the excavated spoils were placed on plastic sheeting in a windrow at a safe distance from the trench as a portion of this material was placed back in the trench after the installation of the LNAPL trench was completed. Any residual spoils that could not be utilized as backfill in the trench was placed on the temporary stockpile pad for off-Site disposal.

The material that was removed from below the groundwater table during the test-pit waste characterization was sampled and disposed off-Site at an appropriate facility based on the waste characterization data.

The specifications required specialized sampling of a small area along the LNAPL Trench alignment located at E-4 for dioxin in addition to total PCBs and other parameters required by the disposal facility.

3.10.3. Installation of the HDPE Sumps

To install the 24-inch HDPE sumps, the excavation of the LNAPL Trench was extended an additional foot below the water table for approximately 10 feet on either side of the pipe to create a sump. Once this elevation was reached and the sub grade was achieved, fabric was once again placed across the bottom and up the sides of the trench box before 6 inches of stone was placed on top of it. When the stone elevation was verified via survey, a perforated 24-inch HDPE pipe wrapped in non-woven fabric was lowered into the trench. The imported washed stone was then installed to a 5-foot thickness in this area and wrapped in fabric. Excavation spoils were then used to bring the balance of the excavation up to the sub grade required for the installation of the concrete vault, the 4-inch diameter HDPE conveyance lines, and the electrical conduit. The conveyance lines and the conduit were extended from the north end of the LNAPL Trench to a junction box located at the northern edge of the Southern Area Cap.

3.11. Monitoring Well Installation

The Monitoring Well Installation aspect of the work was implemented in accordance with Section 5.4.10 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Page 2. The work requirements were established by Specification(s) 02755 – Monitoring Well Installation and depicted on Plan(s) S-4 and C-22 and modified by CCR 115S. The general methods and materials were per submissions of work-related Submittal(s) F133S to assure that the technical specification and plan details met the design criteria/requirements. Upon completion of the Monitoring Well Installation aspect of work, the "as built" condition is documented in Submittal(s) F150S and F151S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the

remedy obligations. The Monitoring Well Installation aspect of the work was initiated on December 7, 2009 and completed on December 10, 2009. Presented below are the further details on the accomplishment of the work.

Sevenson's drilling subcontractor installed six monitoring wells, which are to be used for the post remedial groundwater monitoring program in accordance with the Design Drawing C-22 and Construction Specification 02755 (see Figure 4). All casings, screens, primary and secondary filter packs, bentonite, cement grout, bottom plugs, and well locks were provided in accordance with Construction Specification 02755. Wellhead completions were performed as required in Construction Specification 02755, 2.07. USEPA's contracted oversight consultant, CDM, selected the groundwater monitoring well locations and was present on-Site during the monitoring well installation activities.

Malcolm Pirnie provided a professional geologist (PG) licensed in Pennsylvania to document and log the wells during the well installation. Well boring logs and completion reports are provided in Submittal F150S included in Appendix A.

3.12. Environmental Testing

Throughout implementation of the approved remedy, environmental testing was necessary to ensure that the remedial action activities were completed in accordance with the approved design documents. The main components of the environmental sampling and analysis program included:

- Soil stockpile disposal sampling;
- Construction water management sampling;
- Post-excavation confirmation sampling in the Southern Area;
- Sediment sampling;
- Air monitoring;
- Management of remediation derived wastes; and
- Data validation.

3.12.1. Soil stockpile disposal sampling

The soil stockpile area was modified from the design shown on Design Drawings S-4, C-3, C-13 and C-21 by changing its dimensions and location to accommodate TtEC's excavation activities. The asphalt soil management pad was approximately 155 feet by 155 feet with capacity for sixteen 150 cubic yard stockpiles pending receipt of analytical data. Following receipt of analytical data, the pad provided capacity to combine "like" soils into 450 cubic yard piles pending loading for off-Site transportation and disposal.

The soil piles on the pad were maintained to minimize precipitation infiltration and dust concerns. To minimize precipitation infiltration, stockpiles were covered each day at the end of the work shift with 6 mil polyethylene sheeting and sand bags. Once the piles were sampled, and “like soils” were combined into 450-yard piles, the piles were covered until they were shipped off-Site for disposal. The storage pad also drained to a watertight sump for construction water management.

Excavated soils were stockpiled separately based on the expected concentrations of PCBs (i.e., >50 ppm, >25 ppm and <50 ppm, and <25 ppm). Overburden or cover soils verified to be below 25 ppm were used as backfill in the Southern Excavation Areas. Soil was stockpiled in approximately 150-cubic-yard piles. One composite sample per 150 cubic yards of the soil was collected and analyzed prior to off-Site disposal. Each composite sample consisted of five sub-samples of the soil pile collected at a minimum depth of 12 inches into the soil pile at locations selected to be representative of the pile. Soil samples were collected in accordance with Standard Operating Procedures (SOPs) included in the SAP and analyzed for PCBs using USEPA Method 8082 at a USEPA-approved laboratory.

The analytical data is provided in the submittals included in Appendix A.

3.12.2. Construction Water Management and Sampling

The Construction Water Management and Sampling aspect of the work was implemented in accordance with Section 5.4.1.6 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Page 1. The work requirements were established by Specification 01501 – Construction Water Management and modified by CCRs 21 and 30. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F039, F045, F057, F063, F065, F073, F083, and F101. Upon completion of the Construction Water Management and Sampling aspect of work, the "as built" condition is documented in Submittal F144S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

Water collected from the decontamination pad, the soil management pad, and other Site activities was managed as potentially contaminated construction water. The construction water was pumped to the on-Site treatment system and treated prior to discharge to the Philadelphia Water Department’s (PWD) Publicly Owned Treatment Works (POTW). Both TtEC and Severson obtained permits to discharge to the POTW. Copies of the permits are included in Appendix J. TtEC initially stored the water in tanks after treatment; sampled to confirm that it was below the discharge standards; and then discharged to the PWD POTW.

Analytical results were submitted by TtEC to the Engineer and the PWD prior to the first discharge to the sanitary sewer (Submittal F039). No discharge of treated water commenced until approval was received from the Engineer and the PWD. Upon approval of the first set of results, a 24-hour notice was provided to the PWD prior to initial discharge. A 24-hour notice to the PWD was not required for subsequent discharges. Discharge to the sanitary sewer only occurred when the combined sewer was not overflowing. The treated water was sampled and analyzed periodically per Construction Specifications 01501 and 02410 and the Permit Conditions as issued by the PWD. Sample and analysis records generated for all water discharged was maintained in accordance with PWD requirements. Severson discharged a total of 389,844 gallons of treated water to the PWD POTW. Sampling results indicating the PCB concentrations in the discharged water are available in submittals F045, F057, F083, and F101 in Appendix A. With the exception of discharges on September 1 and 2, 2009, samples were collected and analyzed from each batch of wastewater prior to discharge. On September 1 and 2, 2009, discharges were made continuously and grab samples were collected due to a misinterpretation of the permit.

Severson installed and implemented a temporary waste water treatment plant capable of treating and discharging approximately 50 gallons per minute. The system consisted of up to (9) 21,000 gallon fractionation (frac) tanks depending on the need for adequate storage. The tanks were plumbed in a parallel configuration at the head of the treatment system to allow for sufficient residence time for sediment to settle out of the influent stream to the bottom of the tanks. Once proper settling time had occurred, the water was then sent through a series of four particulate bag filter housings plumbed in a parallel / series configuration. The two primary filters possessed a pore size of 25 microns and the secondary bag filters possessed a pore size of 10 microns. The bag filter sizes were sometimes varied to optimize flow while maintaining compliance with the PWD discharge permit. The waste water treatment plant was designed to remove suspended solid particles onto which the PCBs absorb in the untreated water. Severson's discharge permit also required that the treated water be sampled and analyzed prior to discharge. Similar to TtEC, Severson submitted the analytical data to PWD and obtained authorization from PWD prior to discharge to the POTW. Severson treated and discharged approximately 389,844 gallons of PCB impacted water. The majority of this water was pumped from the soil/sediment management pad where the material dredged from the Deep Sediment excavation and Mudflat Areas was able to dry.

3.12.3. Post-Excavation Confirmatory Soil Sampling in the Southern Areas

The Post-Excavation Confirmatory Soil Sampling in the Southern Area aspect of the work was implemented in accordance with Section 4.1.3 and Volume II, Appendix B – Sampling and Analysis Plan, of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Page 2. The work requirements were established by

Specification 02410 – Sampling and Analysis and modified by CCR 43. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F024, F025, F066, F070, and F077. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

Based on the Pre-Design Investigation's (PDI's) extensive soil sampling program, which included five rounds of sampling and 265 samples, a limited post-excavation confirmatory sampling program was implemented during the remedial action.

The confirmatory sampling program applied to the Southern Excavation Areas of SA-2 and SA-4/5. The SA-2 area was excavated to the lateral extent and depths set forth in the approved Final Design. The SA-2 excavation area was approximately 90 feet by 30 feet. The bottom of the excavation was divided into three 30-foot grids and one composite confirmatory sample was taken in each grid. Each composite confirmatory sample included five (5) grab samples randomly selected from the bottom of the excavation. The three composite confirmatory samples from the bottom of the excavation were analyzed for total PCBs as Aroclor by USEPA Method SW846-3540 or 3541/8082. The results of the analysis of the samples collected from SA-2 indicated that one of the samples (MB-CS-SA2-BOT-02) exceeded the 25 ppm criteria for total PCBs. Following receipt of this data, TtEC continued to excavate in Grid 2 of the SA-2 excavation as required by specification. Once TtEC achieved the specified elevation, it collected another 5-point composite sample from the bottom of the excavation. The results of this sample indicated that the excavation achieved its design intent and the excavation was backfilled.

Confirmatory samples from the excavation of SA-3 were not required in the Design Specifications. Please refer to Section 3.7.1 that describes the SA-3 excavation activities.

Confirmatory samples were collected from select locations along the sidewalls of the SA-4/5 excavation area. Based on the results of the initial confirmatory sampling, it was determined that one sample (MB-SA45-A-7-13) exceeded 25 ppm total PCBs in the northern portion of the excavation. TtEC excavated an additional 10 feet horizontally as per the approved Work Plan and collected another sample. Based on the results of the second confirmatory sampling event in this location it was determined that no further excavation was necessary. Based on the results of the confirmatory sampling, post-excavation surveying, and performance of the post-excavation observation period it was determined that SA-4/5 be backfilled. Please see the attached technical memorandum (Appendix I) of the SA 4/5 closure that was prepared by Malcolm Pirnie and forwarded to the USEPA on December 24, 2008 relative to the Group meeting the obligations of Section 5.4.9 of the approved RAWP and the requirements of ESD #2 to commence the backfilling operations.

3.12.4. Sediment Samples

The Sediment Sampling aspect of the work was implemented in accordance with Volume II, Appendix B - Sampling and Analysis Plan of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, page 29. The work requirements were established by Specification 02410 – Sampling and Analysis and modified by CCRs 53,100, and 104S. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F111S, F116S, and F123S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are the further details on the accomplishment of the work.

Sediment that was removed from the required areas was transported to an on-Site sediment management pad. This material was allowed to decant and then it was sampled and analyzed for total PCBs by method 8082 and TCLP Metals by USEPA method 6000/7000 series. Samples were collected from every 150 cubic yard (CY) stockpile in accordance with the 2009 Severson Remedial Action Work Plan approved by the USEPA. . The samples were a 5 point composite obtained under the observation of USEPA's contracted oversight consultant, CDM. After the samples were obtained and packed, they were shipped directly to Waste Stream Technology, a USEPA approved laboratory, for analysis. If the results returned a PCB content below 25 ppm, and the metals analysis did not contain results above the USEPA action limits, the material was approved for placement in the upland portion of the jobsite, that would ultimately be placed under a minimum two foot cover. If the reported PCB content was greater than 25 ppm but below 50 ppm for total PCBs, the material was disposed off-Site as hazardous waste. If total PCB results were greater than 50 ppm, the material was disposed off-Site in a toxic substance control act (TSCA) regulated landfill. Hazardous material was disposed at Waste Management's CWM Chemical Services, LLC facility in Model City, New York. Severson also disposed of TSCA regulated material at the same facility in Model City, New York. Severson utilized the transportation services of Horwith Trucking to transport RCRA hazardous material and Horwith Trucking, Environmental Transport Group, Inc. (ETGI), or Page Inc to transport TSCA material to CWM of Model City, NY for disposal under profile #NY299774. Disposal documentation was submitted to Malcolm Pirnie and is included in Appendix D.

3.12.5. Air Monitoring

The Air Monitoring aspect of the work was implemented in accordance with Section 4.1.6 and Volume II, Section 6.0 of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP, Site Safety and Health Plan, Section 7.0. The work requirements were established by Specification 01401 – Health and Safety and modified by CCR 19. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F071 and F148S. Based on

this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are further details on the accomplishment of the work.

Both TtEC and Severson performed air monitoring, dust and organic vapor, during the remedial action construction activities to assess fugitive dust and organic vapor levels in the worker breathing zones. TtEC performed air monitoring during the intrusive activities related to excavation in the Courtyard and Southern Areas and Severson performed air monitoring during the sediment excavation activities in the Mudflat Area and the Deep Sediment Area. Severson monitored for air particulates, lower explosive limits (LEL), volatile organic compounds (VOCs), carbon monoxide, hydrogen sulfide, and oxygen levels. Both a MultiRAE PGM50 multi-gas monitor (for VOCs, hydrogen sulfide, carbon monoxide, oxygen, and LEL) and a TSI DustTrak (for airborne respirable particulates) were used at four perimeter locations, as well as downwind locations. All results were below action levels established in the approved Site specific Health and Safety Plan and work concluded without air related issues. Air monitoring data is provided in Submittals F078 and F148S in Appendix A.

3.12.6. Management of Remediation-Derived Wastes

The Management of Remediation Derived Wastes aspect of the work was implemented in accordance with Section(s) 4.13 and Volume II, Appendix F of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP. The work requirements were established by Specification 01640 – Off-Site Transportation and Disposal and modified by CCRs 29, 55, 62, 77, 83, and 118S. Additionally, the construction data collected during this work was according to the design requirements and is presented in Submittal(s) F008, F024, F025, F026, F037, F040, F046, F054, F059, F060, F063, F066, F067, F068, F069, F074, F075, F076, F079, F080, F085, F086, F088, F093, F094, F096, and F102. Upon completion of the Management of Remediation-Derived Wastes aspect of work, the "as built" condition is documented in Submittal(s) F143S and F149S. Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. Presented below are further details on the accomplishment of the work.

Remediation-derived waste (RDW) consists of all materials generated during Site construction activities that may be contaminated with chemicals of concern identified at the Site. RDW consists of many different types of potentially contaminated materials, including but not limited to, personal protective equipment (PPE); disposable sampling and decontamination equipment; well development and purge water; and decontamination fluids. TtEC was required to notify USEPA of any off-Site shipment of waste material (volume greater than 10 cubic yards) from the Site to an out-of-state waste management facility in accordance with the Consent Decree. Waste characterization and disposal procedures of RDW were discussed in Appendix F of Volume II of the RAWP,

(Waste Management Plan). TtEC and Severson followed the procedures outlined in Appendix F of the RAWP.

3.12.7. Laboratory Analysis and Data Validation

The Laboratory Analysis and Data Validation aspect of the work was implemented in accordance with Volume II, Appendix B - Sampling and Analysis Plan and Appendix D – Quality Assurance Project Plan (QAPP) of the approved April 4, 2008 RAWP and adopted or modified by the July 6, 2009 RAWP. The work requirements were established by Specification 02410 – Sampling and Analysis and modified by CCRs 95S.

The decision making analytical results obtained from the laboratory underwent a systematic data validation to provide assurance that the data were adequate for use. The validation was performed by Environmental Standards, personnel who have appropriate training and/or experience in performing data validation for the analyses of interest associated with the project. Validation was performed based on an evaluation of project objectives, method-specific QA/QC information (such as holding times, calibration records, laboratory and field blanks, duplicate precision, and surrogate and matrix spike recovery) using M3 procedures in USEPA Regions III's Modifications to the National Functional Guidelines for Inorganic Data Review (1993 for inorganics, 1994 for organics). Nonconforming QA/QC results were evaluated with respect to their implications for data reliability and usability using these guidelines. Qualifiers (as applicable) were added to the data results. The QAPP (Appendix D of Volume II of the RAWP), further discusses data validation.

Based on this information, the ENGINEER concludes that this aspect of the WORK meets the remedy obligations. The data validation report is located in Appendix K.

3.13. Final Inspections and Certifications

A Pre-Final Inspection was performed by the USEPA and representatives of the Utility Group on January 20, 2010. A list of items to be repaired, corrected, or addressed was developed during the Pre-Final Inspection. The list is provided below:

1. Repair eroded soil at the second drainage swale along the western side of the Site (near the mudflat area).
 - *Completed as of January 22, 2010.*
2. Consider/evaluate feasibility of planting shrubs or other erosion resistant vegetation in this area.
 - *Planting shrubs in spring/summer of 2010 was judged to be premature based on guidance from the environmental restoration experts and could add unnecessary maintenance issues to the project. The Group recommended re-assessing the*

need for shrubs or other woody species in the Fall of 2010 once the landfill native grasses have experienced a growing season which was acceptable to the EPA.

3. Install additional stakes in the erosion and sediment (E&S) control measures (coconut logs) installed in the former boat ramp area to the east of the eastern return of the sheet pile wall. Inspect all of the E&S measures and install additional stakes as necessary. Also, inspect E&S measures for erosion and/or undermining and repair as necessary.

■ *Completed as of January 22, 2010.*

4. Install E&S measure, preferably straw mat, on the soil just outside of the fence near the eastern return of the sheet pile wall.

■ *Completed as of January 22, 2010.*

5. Evaluate drainage conditions in the swale that runs along the eastern perimeter of the Site. Provide means to drain standing water to drain from area.

■ *Completed as of January 22, 2010.*

6. Review remedial action plans and scope of work to determine whether or not additional trees are to be planted along the river bank near the mudflat area.

■ *Malcolm Pirnie reviewed the final design report, specifications, drawings and work plans prepared by AMEC, TtEC, and Severson and did not find any references requiring trees to be re-planted in the riverbanks adjacent to the Delaware River or tidal mudflat areas. However, as part of the soil cover inspection during the operation and maintenance phase, the Engineer will evaluate the need to add site improvements for erosion protection and drainage.*

7. Add a sign with EPA's contact information inside the main gate of the Site.

■ *Two wooden signs, one along Cottman Avenue and one along Milnor Street, as well as four metal signs were installed at the Site on March 9, 2010.*

8. Install a shim/wedge in the tieback located in the western bend in the sheet pile wall from the river toward the mudflat area.

■ *Severson installed the metal shim/wedge in February 2010.*

9. Install stakes or other similar safety demarcation along the stone access road to the west of Building 7.

■ *Completed as of January 22, 2010.*

10. Paint monitoring wells with a bright color (yellow or orange) to increase visibility.

■ *Completed as of January 22, 2010.*

A Final Inspection was performed by the USEPA and representatives of the Utility Group on April 29, 2010. Several items that will be addressed as part of the long term operations and maintenance (O&M) of the Site were identified during the Final Inspection. These items are not considered to be associated with the construction aspect of the work and

should not prevent USEPA from considering the construction activities to be complete. A list of the items that will be addressed as O&M items is provided below:

1. Soil & Erosion - Repair of silt fence along Cottman Ave (in vicinity of school rooms across street) where fence angles into property.
■ *Silt Fence repaired on 4/30/10 by Enviroscapes.*
2. Soil & Erosion - Repair rill at northwest gate along Cottman Ave and install hay bale.
■ *Repaired on 4/30/10 by Enviroscapes.*
3. Soil & Erosion - Repair rill along slope to eastern boundary fence-line at approximately 150 feet north of the southeast corner of Site.
■ *Repaired on 4/30/10 by Enviroscapes.*
4. Soil & Erosion - Repair rill along slope to eastern boundary fence-line at approximately 700 feet north of the southeast corner of Site.
■ *Repaired on 4/30/10 by Enviroscapes.*
5. Intrusive Vegetation - Consider eradication plan for phragmites along central portion of eastern fence line.
■ *Herbicide applied on 8/27/10.*
6. Intrusive Vegetation - Consider herbicide treatment (Utility Group and EPA approval needed) along the Delaware River Bank for knotweed.
■ *Herbicide applied on 8/27/10.*
7. Intrusive Vegetation - Consider herbicide treatment (Utility Group and EPA Approval needed) along Milnor Street fence line and fence line along Mudflat PWD drainage ditch for knotweed.
■ *Herbicide applied on 8/27/10.*
8. Sheet Pile Wall Maintenance - Revitalize the epoxy/paint at the penetrations from the tieback rods and sheet interface.
■ *Performed the tie rod epoxy repairs and sheet pile wall repair painting during weeks of August 16th and 23rd*
9. Sheet Pile Wall Maintenance - Revitalize the epoxy/paint at various locations along sheet pile alignment (especially in Zone 3).
■ *Performed the tie rod epoxy repairs and sheet pile wall repair painting during weeks of August 16th and 23rd*

10. Marine Safety - Investigate with US Coast Guard appropriate warning/marker needs for the marine mattress locations.

- *Installed three warning buoys in the Delaware River adjacent to the Site. Installation of these buoys was approved by the USCG.*

3.13.1. Aerial Photographs

Post-construction aerial photographs of the Site were taken in June 2010. These photographs are included in Appendix M.

3.13.2. Post-Establishment Evaluation

The post-establishment evaluation was conducted on May 23, 2012 by ENVIRON and EPA. In addition, a final survey was performed by Rettew in May 2012. The evaluation and survey indicate that vegetation is fully established and that the cap thickness has been maintained. A summary of the post-establishment evaluation and survey can be found in Appendix T.

4. Operations and Maintenance Activities

Operation and maintenance activities are minimal considering the design of the corrective measures. Operation and maintenance activities and frequencies are summarized below:

- Mowing of Site - Annually
- Vegetation Survey – Annually
- Site Inspection/Condition Survey – Quarterly
- Elevation Survey – Annually
- Inspection of Building #7 – Annually
- Groundwater Monitoring:
 - Quarterly for two years
 - Semi-Annually for two years
 - Annually thereafter
- LNAPL Monitoring:
 - Every two weeks for one quarter
 - Quarterly thereafter
- Caged Worm Studies
 - Annually for two years
 - Additional studies if needed
- Surface Sediment Sampling – Concurrent with caged worm studies
- Benthic Community Survey – Annually for two years
- Diver Assisted Elevation Survey – Annually
- Elevation/Bathymetric Survey – Annually
- Storm or Man-made Event Survey – As needed
- Sheet Pile Wall Monitoring
 - Monthly for six months
 - Quarterly thereafter
 - If rotation is less than two degrees during first two years, monitoring will cease
- Fish Tissue Study – Two events

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5. Contact Information

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